

A ZOO LAYOUT FOR
SASKATOON, SASKATCHEWAN

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Abstract

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The thesis is divided into two main sections.

Part One deals with the general characteristics of zoological parks. The purpose and nature of zoos are studied, and an attempt is made to isolate the elements which the planner must consider in designing a zoo layout.

In Part Two these criteria are applied to a site in Saskatoon, Saskatchewan. The features of the site and the requirements of the community are discussed. A theoretical model for a zoo layout is presented, and adapted to fit the site in question. The first stage of this layout is presented in some detail. Finally, a growth sequence is proposed to ensure the orderly development of the site, so as to maximize animal comfort and visitor entertainment.

Preface

One of the main difficulties facing the author in approaching a new field of planning was the variable nature of zoo literature. While the biological aspects of zoo management are generally well documented, relatively little has been written about the process of zoo planning. Hediger's Wild animals in captivity and Crandall's The management of wild mammals in captivity deal exclusively with the behaviour and care of zoo animals; the International Zoo Yearbook compiles zoo statistics from many sources and reports new ideas in architecture and display techniques; the periodical Parks and Recreation and A zoological park -- Why, Where, How edited by Wilcox are largely concerned with promotional aspects of zoological parks. One facet of zoo design which has received scant attention is provision for the comfort and enjoyment of the visitor to the zoo.

The design of a zoo layout necessarily involves consideration of the visiting public. The designer must be aware of the particular functions of recreation areas and should have an appreciation of the characteristics

of pedestrian movement. The author therefore has drawn on the related disciplines of landscape architecture, site planning and exhibition design, in order to formulate principles for zoo design.

In addition the author has examined the plans of many existing and proposed zoos. Inevitably characteristics vary from one site to another. Plans suitable for a large zoo serving a metropolitan population have apparently little relevance to an animal collection in a small prairie town. Yet many fundamentals are valid for all zoos.

Thus in studying the several branches of zoo literature the author has taken note of many innovations tried and proven elsewhere, to test in relation to the site in question. The plan presented, therefore, is inevitably an amalgam of many ideas, some original, many consciously adapted. In addition the author has been fortunate in being able to discuss zoos in general with several people more experienced in the field of zoo planning and it is likely that some of the good sense they spoke has been incorporated in this thesis. In no way, however, can they be held responsible for any errors or misjudgments which may occur in this study.

Acknowledgments

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Part One

Chapter 1

Introduction

Predictions of the quality of life which will be experienced by the average urban dweller in the future inevitably make some reference to rising personal incomes, and a simultaneous shortening of the working week.¹ As more time is devoted to leisure activities there will undoubtedly be a demand for additional recreational facilities.² One result of this situation has been the establishment of various bodies and Planning Commissions to estimate the areas which must be set aside for National

¹Marion Clawson, R. Burnell Held, and Charles H. Stoddard, Land for the future (Baltimore: Johns Hopkins Press, 1960), p. 184.; Referring to the United States they estimate that "by the year 2000 there will be 310 million people in this country compared with 170 million in 1956; that per capita income will be \$ 3660 (in 1955 dollars) compared with \$ 1630 in 1955; that the average work week will be 28 hours compared with forty in 1956 . . ."

²Charles K. Brightbill writes: "By the year 2000 there will be ten times the demand for outdoor recreation in the United States as there is now."; in The challenge of leisure (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1960), p. 63.

Parks, weekend cottages and other amenities which permit the urbanite's escape from the city. There is a current trend towards increased use of the countryside, not only during vacations, but throughout the year. As Abrams points out, "it is exurban recreation that has benefitted most from the leisure-time extension."³

While there is every indication that travel outside urban areas will increase, it seems likely that growing demands will also be made on intra-city recreation facilities. Ann-Louise Strong writes:

The magnitude of the surging demand for urban recreation lands can be seen by the following comparison: By the year 2000 the national population should double; the general nationwide recreation demand should triple, but the demand for recreation opportunities "a half-hour from home" is estimated to increase tenfold.⁴

There are several reasons for this urban bias. The relative poverty of many urban dwellers is one cause. Purdie states that:

Today the average Canadian has some 50 hours of leisure time to fill in a week -- and with few exceptions, he can't afford to go far from home to find his recreation outlets.⁵

³Charles Abrams, The city is the frontier (New York: Harper and Row, 1967), p. 302.

⁴Ann-Louise Strong, Open space for urban America (Washington, D.C.: Government Printing Office, 1965), p. 4.

⁵James Purdie, "New outlook for parks and recreation," Civic Administration (September, 1962), p. 54.

While the commentators might suggest that increased leisure time will be accompanied by a gain in real income,⁶ there is little to indicate that this new wealth will be equitably distributed. Plans for recreation will still have to cater for the poorer sector of the urban population.

There are other factors which tend to favour an emphasis on purely urban facilities. There is, for example, the effort required to escape from rapidly growing urban centres. The friction caused by the urban fabric may deter people from leaving home for less than two or three days at a time. Instead, they look to the city for entertainment. This demand will be of particular significance as the "working day," like the "working week," tends to contract. Undoubtedly the provision of adequate leisure-time outlets will claim a high priority in the future. Thus Abrams states that: "Better in-city recreation is a sine qua non for city survival and urban renewal."⁷

These facts lend contemporary significance to this thesis, which considers the planning of a strictly urban recreational facility. A zoological park is a highly specialised amenity, for the relatively high cost of its

⁶ Brightbill, The challenge of Leisure, p. 17.; claims that the "gain in real income makes it possible for more families to buy more of leisure's services and commodities."

⁷ Abrams, The city is the Frontier, p. 303.

establishment and upkeep require that it have the support of a population of urban dimensions. In return it offers its local community special opportunities for recreation and entertainment.

The next chapter of the thesis, therefore, will deal with the contribution of a zoo to a community. Subsequent chapters in Part One attempt to study the nature of a zoo, and suggest criteria which might be used in planning a zoo as a unique and exciting entity in the total picture of urban recreation. Part Two deals with the application of these principles to a site in Saskatoon, Saskatchewan.

Chapter 2

The Role of a Zoo in a Community

Most of the zoo literature which is normally encountered is written for schoolchildren. This fact reflects — and indeed may have perpetuated — a common notion that zoos are for children. This, according to W.G. Conway, Director of the New York Zoo, is a myth. He points out that, on the contrary, "zoos are basically aimed at adults," as evidenced by the fact that of all visitors to San Diego Zoo, 55.2% are over 16 years, at Frankfurt 73% are over 15 years, while Chicago Zoo cites 2.39 adults to every child.¹ A zoo, therefore, has the potential to attract visitors from all age groups. This propensity to entertain and interest many kinds of people,

¹William G. Conway, "Why have a Zoo," Parks and Recreation, I, vi (June, 1966), 490.

from family parties to organized group outings, is a fundamental characteristic of a zoo. Its major contribution to a community is the opportunity for recreation it affords. Nevertheless, it can fulfill other functions. A zoo may act, directly or indirectly, as a source of revenue in the community. In addition, it may fulfill educational, research and conservational roles. Each of these elements is considered below.

Recreation

Conway writes:

As a recreation resource, it is hard to find anything to compare to zoos. More than 70 million people will visit American zoos this year; that is more than the combined attendance at the national football and baseball games.²

A comparable figure for visitors to Canadian zoos is over seven million annually -- equivalent to a third of the population.³ The evident popularity of zoos can be explained in large part by the nature of their exhibits. Besides their exotic or romantic appeal, the animals can entertain visitors and sustain their interest during successive visits

²Ibid.

³"World zoos and aquaria -- Canada," International Zoo Yearbook, VII (1967), 245-47.

by their constant activity and variety.

In many zoos this rapport between animals and visitor is enhanced by careful planning and landscaping to place the animals in an attractive setting. Inviting paths and sheltered rest areas cater for the casual visitor, and ensure the best possible views of the exhibits. The environment is at once stimulating, aesthetically pleasing and relaxing, and functions as an enclave of nature in the midst of the city.

Revenue

Zoos are generally constructed for the benefit of the immediate community, but often they have a wider appeal. The following table indicates the drawing power of some of the larger zoos in the United States.

ORIGIN OF VISITORS⁴

<u>San Diego</u>	<u>Milwaukee</u>	<u>Washington, D.C.</u>
25% local	40% local	20% local
35% from region	40% from State	30% Metropolitan area
40% international	20% out of State	50% ex-Metropolitan

⁴San Diego and Milwaukee figures from; R. Moriyama, Metropolitan Toronto Zoological Park, Glen Rouge, feasibility study and master development plan (Toronto, 1968), p. 41.; Washington figures from; T.H. Reid and A. Mindlin, "Where do visitors come from," International Zoo Yearbook, III (1961), 43-46.

Though a small community zoo is unlikely to evoke such widescale interest it may still encourage out of town visitors, and so may stimulate business in local stores, restaurants and hotels.

Education

While many people visit a zoo simply to be amused, they may learn something incidentally. The mere juxtaposition of living zoological exhibits, and notices giving some basic facts about their native habitat or biological functioning, can act subtly as an informative influence, illuminating a range of topics:

from enhancing an understanding of geography to the development of a mature concept of sex; from an appreciation of the meaning of the term renewable resources to concrete ideas about the evolution of man.⁵

A zoo may also participate in formal education, and indeed many zoo directors feel a responsibility to do so.⁶ Thus groups of children may be exposed to a zoo under the supervision of a teacher or guide, and after investigating this unique sector of animal life, may be

⁵Conway, "Why have a zoo," p. 489.

⁶Typical examples are Regent's Park, Bronx and San Diego Zoos.

encouraged to find out more about the related biological and geographical sciences. The atmosphere is sufficiently non-academic and enjoyable to coax otherwise slow learners into participation. In addition, a zoo working in close co-operation with local schools and universities can act as an academic resource for students of biology and zoology. Thus, institutions like the Staten Island Zoo have been designed and built to form "a unique educational institution."⁷ They aim to provide an auditorium, library, biological laboratories and study rooms, and emphasize the importance of study tours, junior zoologist clubs and zoo news bulletins.

Research

By its nature as a collection of rare wild animals a zoo is in a unique position to carry out scientific observations and research. The compilation of facts and statistics about animal habits and development in the day to day management of a zoo can be an important contribution to scientific knowledge. Where a special research station is attached to the zoo, as at San Diego,⁸ the benefits are

⁷"Educational scheme at Staten Island Zoo, U.S.A.," International Zoo Yearbook, I (1959), 36.

⁸San Diego Zoo (San Diego: The Zoological Society of San Diego Inc., 1966), p. 109.

correspondingly greater, especially if such a foundation is linked with a local university.

Conservation

A positive contribution which can be made by zoos, both individually and collectively, is the preservation of endangered species of wild-life. Several species, including the Wisent (European Bison), Pere David's Deer and Przewalski's Horse are extinct in the wild but are flourishing in captivity. Zoos have accepted a responsibility for wild-life, both in captivity and in their native habitat. One director writes:

Zoos have little or no right to exhibit forms of animals whose continued existence in the wild is highly doubtful, except for the fact that in certain cases zoos can play a highly important part in preserving species whose numbers are few in the wild state or who have actually disappeared.⁹

Zoos may make a contribution to conservation, both by breeding the rarer species, and by restocking depleted herds. In their role as educators they may also be able to foster in visitors a respect for animals and their place in world ecology.

⁹Fairfield Osborn, "A new opportunity -- Zoos help wildlife," International Zoo Yearbook, IV (1962), 66.

Thus a zoo may be a valuable asset to the city which supports it, by entertaining, educating, and by introducing people to wild-life that they would not otherwise encounter. It serves as a "cultural element of prime importance,"¹⁰ and may become a source of community pride, and a facility which "helps make the community a good place in which to live."¹¹

In addition it can play a role of significance in the larger environment from which urban dwellers are being increasingly alienated by their own artificial milieu:

Urbanization with its factories, roads and airports, pollution of the air and waters, use of pesticides and other lethal chemicals, large scale farming, careless shooting -- these are only a few of our social practices undertaken without thought on how they affect the living environment of our land.¹²

It is perhaps appropriate that the city which plays a leading role in the destruction of the wild animals' habitat, should be responsible for the construction and care of a refuge for the threatened wild-life.

¹⁰Heini Hediger, Wild animals in captivity, translated by G. Sircom (New York: Dover Publications Inc., 1964), p. 3.

¹¹Arthur T. Wilcox, ed., A zoological park, Why, Where, How (East Lansing, Mich.: Michigan State University, n.d.), p. 5.

¹²Michael J. Walker, "Endangered wildlife," Parks and Recreation, III (November, 1968), 10.

Chapter 3

The Nature of a Zoo

The custom of keeping wild animals in captivity is thousands of years old. In the twelfth century B.C., Chinese rulers kept a collection of wild beasts in their "Garden of Intelligence." Subsequently, the ancient Egyptians, Greeks and Romans established menageries for sacrifice and worship, and for their sporting or curiosity value.

During the Middle Ages many European monarchs kept private animal collections, but it was not until the eighteenth century that the public were allowed to view such collections. The Jardin des Plantes, established in Paris in 1793, was the first "zoological garden" and as such was the forerunner of the modern zoo. In the century following its endowment many zoological gardens were

established, in Europe (Regent's Park, 1829) and America (Philadelphia, 1859).¹ In general the approach to animal care and housing was crude, and animal mortality rates were high. However, the zoological garden satisfied the public's taste for the outlandish, while the carefully landscaped surroundings provided a pleasant environment for a day's outing.

Today the "zoological garden" is regarded as a "pre-Victorian and seemingly old-fashioned institution."² This term is as outdated as the nineteenth century concepts of exhibiting exotic beasts in narrowly confined barred cages or "stuffy, overheated glass boxes."³

Yet, while the approach to zoo management has altered radically, the character of the modern zoo is hardly different from its predecessor. It aims to be fundamentally, a collection of zoological exhibits in a "garden" setting. Its directors may be very conscious of the educational and conservational roles of the zoo, and may make admirable advances in these directions, but to the average urban dweller and casual visitor, its success is measured by the enjoyment it affords. The old-fashioned

¹"Zoological Gardens," Encyclopaedia Britannica, 1963, XXIII, 973.

²John Barr, "Our beastly pleasures," New Society, June 29th, 1967, p. 945.

³Ibid, p.946

"pleasure garden" concept is still valid. The visitor expects his visit to a zoo to be an enjoyable experience, providing entertainment, tranquil surroundings and high quality services.

The modern zoo, therefore, is basically a well-landscaped park, where:

it is as important to the zoo of today to have a consulting landscape architect as it is to have a consulting veterinarian.⁴

Within its "natural" setting, however, quite a complex organisation exists to ensure the satisfaction of the visitors' demands. If an analysis is made of the component parts of the zoo it can be seen that there are several separate "systems" in operation. These can be classified as Animal Enclosures, Maintenance Circulation, Pedestrian Circulation, Visitors' Services and Visitors' Conveyances.

Enclosure System

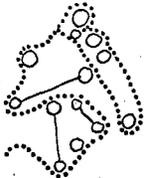
The sets of buildings and paddocks housing the animals are discrete elements within the park. They are rigidly defined by barriers or moats which separate animal "space" from public "space",

⁴Philip W. Ogilvie, "Making the most of our zoos," Parks and Recreation, IV (January, 1969), 50.



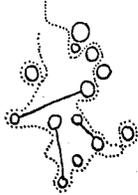
and confine each exhibit to its own territory. Most animals require both indoor and outdoor space, and these must be linked in such a way that the animal never comes into contact with the public. As each species has its own requirements of space, micro-climate, shelter, exercise and so on, various complicated measures may be employed to ensure the correct environment for each animal. Frequently this means its complete isolation from direct human contact.

Maintenance System



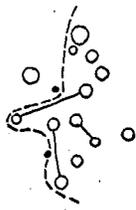
In order to ensure the animals' well-being a large maintenance staff is needed to clean enclosures and feed and care for their occupants. Thus a maintenance system is a vital element in a zoo, requiring access routes to every pen and paddock from a central service core. Such a system must be linked to all enclosures and yet separated from them in order to ensure the keepers' safety.

Pedestrian System



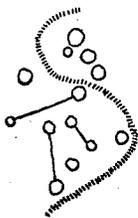
The main requirement of the public circulation system is to provide visual, but not physical access to every enclosure, and the layout may be designed to optimize the visual impression. The pedestrian paths interweave amongst the enclosures, but the barriers between the two areas ensure their discreteness. Often the maintenance system is independent of the visitors' area, though this separation, while desirable in terms of safety and aesthetics, is rarely complete.

Service System



The facilities serving the public form another separate entity in the zoo. Restaurants, washrooms, refreshment kiosks and souvenir shops are located throughout the public area, but their provisioning and upkeep require a separate system of functioning

Visitor Conveyance System



Many zoos provide an internal transportation service for their visitors, in the form of trackless trains, water-buses or motor-coaches. Occasionally, as at Washington Zoo, these follow a route independent of

the pedestrian system, but such vehicular separation is, as a rule, uncommon.

Integration

A zoo, therefore, is a function of many interdependent elements. Though to a large extent spatially discrete, they are mutually supporting. The malfunction of any system affects the success of the others, and so detracts from the success of the zoo -- if the consequences are not actually disastrous. Fortunately, tragedies in zoos are rare, for in general, their layout conforms to the minimum standards of safety implicit in the separation of public and animal space. Beyond this, however, the functioning of the zoo systems varies greatly.

A great many zoos have reached their present proportions by a process of accretion from a small nucleus. They have expanded peripherally, frequently following no set pattern beyond that dictated by topography. In many cases the end-product is a delightful *mêlée* of animals, informal paths and unexpected rest areas. On the other hand, such unplanned growth may have unfortunate results. The zoo at Regent's Park, London, for example, has been severely criticized because of its inept layout:

The public spaces and circulation at the zoo are becoming so labyrinthine, obscure, overcrowded and squalid that the charming virtues of compactness, of riches in a little space, are being lost. A lot of hard work and radical thought has got to go into tarmac and paving, steps and ramps, seats and services and segregated circulation, if the buildings are not to finish up as pandemonium, or as unvisited white elephants.⁵

This damning criticism was written in spite of the fact that a master plan for the zoo has been in existence for many years. The zoo, however, was established over a century ago, and so for much of its life its evolution has been more or less unguided. The present structure suffers through the lack of an original overall concept.

London is perhaps exceptional in the intensity of its problem (the zoo exhibits more species per acre to more people per acre than any other zoo in the world).⁶ There is, however, a lesson in its experiences for many smaller institutions. The public is always eager to see new additions to their zoo, both young animals and new species. While it is usual for a master plan to be drawn up before the construction of a new zoo, this does not inevitably take account of the potential for growth in subsequent decades.

This thesis, therefore, advocates long term zoo

⁵Reyner Banham, "Zoo a la mode," New Statesman, March 12th, 1965, p. 411.

⁶Ibid.

planning. As pointed out, the zoo may be a delightful urban amenity -- or it may deteriorate into a chaos of pedestrian traffic jams or an enervating zoological sprawl. Suitable balance, and the integration of the several systems described earlier can only be achieved by careful forethought. Zoo planning, therefore, requires that many criteria be considered simultaneously. An attempt has been made to isolate these criteria, and each is discussed at length in the following chapter.

Chapter 4

Criteria for Zoo Planning

The Animals

The animal exhibits in a zoo are its initial and obvious attraction. The choice of species for display and the quality of their housing will, to an extent, determine the institution's success. Both aspects can be seen as the responsibility of the planning team.

Often, smaller zoos confine themselves to the exhibition of native species. The reasons are obvious, for animals adapted to the local climate are relatively easily housed and cared for. Native stock, however, rarely act as a "magnet" to local residents, and without at least a few exotic species an animal collection rarely merits definition as a "zoo."¹ Writing of American zoos, Osborn pointed out that, "While we like to exhibit our

¹"Zoological Gardens," Encyclopaedia Britannica, 1963, XXIII, 972.; defines zoos as collections of "mainly exotic" animals.

own fauna, most of our great prizes come from other parts of the world."² The visiting public expects to be impressed by the species displayed at the zoo, and tends to be unmoved by indigenous animals. Public opinion, therefore, can influence the quality of zoo exhibits. Barr writes:

Most zoo directors . . . agree that the public is becoming choosier, demanding higher standards and more dramatic animals in zoos. A few raggedy coypus in a cage just won't do these days: . . . television has taught people to expect at least a hairy nosed wombat instead. A zoo must provide animals that just don't loll about lazily but perform -- such as apes and sea lions.³

The zoo, therefore, must live up to standards imposed by a discriminating public, and the designer must be prepared to cater for their demands. Most people have "favourites," and some animals are more popular than others. Desmond Morris made a survey of the likes and dislikes of children at London Zoo. The most popular species proved to be monkeys, chimps, horses, bushbabies, giant pandas, bears, elephants, lions, dogs and giraffes, while snakes, spiders, lions, rats, crocodiles, skunks, gorillas, hippos, rhinos and tigers were generally disliked.⁴ A similar

²Fairfield Osborn, "Wildlife conservation," Parks and Recreation, I (August, 1966), 647.

³John Barr, "Our beastly pleasures," New Society, June 29th, 1967, p. 945.

⁴Desmond Morris, The naked ape (Toronto: Bantam Books, 1967), pp. 197-207. The inclusion of lions in both lists has been explained by the fact that young children generally like big animals, while lions later fall from popularity. Popular with small children, they are disliked by older children.

informal survey conducted by Gerald Iles, led to the following list of priorities;⁵

1. Apes and monkeys
2. Lions and tigers
3. Elephants
4. Bears
5. Sea lions.

The designer can utilize such information. It shows which animals visitors want to see, and indicates where people will tend to linger and cause pedestrian traffic jams, unless the layout is designed to cope with such congregations.

The choice of species for display is obviously a critical factor in a zoo layout. Frequently the more popular animals are the most expensive to purchase and maintain, and any attempt by a smaller institution to provide make-shift shelter for a costly exhibit will be unsatisfactory for the public as well as for the animal. Morris suggests that smaller zoos should not attempt to show one of every species, striving to be a pale shadow of some major institution. Each zoo should evolve its own specialisation and work to make it the best display of its kind. The animals would gain by living in groups, rather than in solitary confinement; the public would be prepared to travel considerable distances to see an

⁵Gerald Iles, My home in the zoo (New York: Doubleday and Co. Inc., 1961), p. 99.

outstanding exhibit; and specialisation would have the further advantage of enabling intensified research into a particular field of zoology.⁶ A decision to adopt such a policy will obviously affect the structure and layout of the zoo.

Enclosures

After selection of the species for display, the designer must select sites for their enclosures. In the eyes of most zoologists this has priority in zoo planning. Paul Leyhausen sets out the following "indisputable order of values:"⁷

- i. Subjective well-being and comfort of future inhabitants;
- ii. Objective welfare, hygiene;
- iii. Easy working conditions for the keeper(s); no undue distances to walk; everything at hand where it is needed, easy cleaning, easy moving of animals, etc.;
- iv. Ease of observation and circulation for visitors;
- v. Artistic design (architecture).

The validity of such an ordering is, perhaps debatable. The zoo exists largely for the benefit of the visiting public, and it would seem that they should have prime consideration in the allocation of priorities. Nevertheless it is

⁶ Desmond Morris, "Must we have zoos? Yes but . . .," Life, November 8th, 1968, pp. 78-86.

⁷ Paul Leyhausen, "Smaller cats in the zoo," International Zoo Yearbook, III (1961), 15.

reasonable to insist that the location of the animal enclosures be given careful consideration. Animals, particularly exogenous species, rarely flourish under unfavourable conditions, and make poor exhibits. It is in everyone's interests, therefore, that they be given adequate living space.

Many zoo visitors have a sympathetic attitude towards caged animals. They frequently have scruples about the ethics of caging, and therefore tend to respond more favourably to animals which are kept in natural-looking surroundings. A zoo director writes:

The ideal of the modern Zoological Park is to exhibit its inmates, or to allow them to exhibit themselves with the utmost possible degree of naturalness. The aim of its designer should be to keep his animals in such a way that within the limits of the reasonably practicable they may enjoy a degree of liberty in surroundings resembling, to some extent at least, those to which their race is accustomed.⁸

This, in fact, is the trend found in most zoos today, for bars are less in evidence, being replaced wherever possible, by moats or by armoured glass. Thus the impact of the animal on the spectator is the greater for the lack of an obvious intervening barrier -- a fact which the designer may well utilize to heighten the effect when determining the location of paths and viewing points.

⁸ T.H. Gillespie, The story of Edinburgh Zoo (Oldcastle: Michael Slains Publishers Ltd., 1964), p. 17.

Another trend which is evident in many zoos is the "liberation" of as many compatible species as possible in large "free range" paddocks. The animals apparently benefit from such a natural approach and the visitor has the opportunity of seeing some of the symbiotic relationships which exist in nature.

Though an animal may thus appear to be at liberty, it must nevertheless be confined to an enclosure. The designer should therefore do everything possible to ensure the animal's acceptance of its cage or paddock as its own territory and to mark and defend it as such. It should be large enough to allow the animal sufficient space in which to exercise. However, Hediger writes:

With his anthropocentric tendency, man has always been apt to form a one-sided idea of the fate of a wild animal living in captivity. The chief factor of an animal's life in captivity, or, at least, its chief drawback, was supposed to be restriction of space. The amount of space at the animal's disposal has had too much attention, while the quality of the space on the other hand has received too little.⁹

The quality of an enclosure will vary according to aspect. Generally, north-facing sites are poor, as most animals benefit from some exposure to sun. The amount of shelter afforded by buildings or plantings will also

⁹Heini Hediger, Wild animals in captivity, translated by G. Sircom (New York: Dover Publications Inc., 1964), p. 31.

determine the value of an enclosure. The micro-climatic effects may be of greater significance to animals confined indoors. Each species has its own optimum temperature and humidity, and in the case of the more delicate species it may be necessary to create a totally artificial environment. The welfare of animals may also depend on details such as the type of floor covering or the amount of cage furniture available for climbing, shelter or play.

Service Functions

The maintenance sector is the functional element in the zoo and it is usually hidden from the visiting public. It involves a core area, or headquarters, which acts as a reception bay for provisions, building materials or new exhibits; a storage area; workshops; offices and veterinarian's quarters. Space may be required by the zoo gardeners for greenhouses and storage rooms. Living quarters for the director or caretaker could also be considered as part of the maintenance structure.

The core is the nucleus of a network of secondary paths giving access to every enclosure. In caring for large animals, considerable quantities of food, bedding and so on have to be moved, and so these routes must be

able to accommodate small vans or trucks.

In many zoos, pedestrians and service vehicles share the same paths. Obviously, some form of pedestrian -- vehicle separation should be advocated, if the servicing of enclosures is not to disrupt visitor circulation. The same principle applies to access routes needed for the provisioning of restaurants or soft drinks kiosks. Such separation may be seen as spatial separation (with two paths to every enclosure) or as temporal separation (with limited periods of access) but it is apparently a necessary measure if the zoo is to exhibit effectively.

While every effort is generally made to ensure the visitor's comfort by shielding him from the "business" part of the zoo, there is evidence that many people are interested in how the zoo functions. For this reason some zoos allow their visitors to view the kitchens or even complicated pumping or refrigeration equipment¹⁰ from the public area. In general, however, it is valid to say that wherever possible the public and the maintenance circulation systems are kept separate.

Maintenance circulation is evidently a vital consideration in a zoo. There are other systems, however,

¹⁰Penguin house, Duisburg Zoo; shown in International Zoo Yearbook, VII (1967), cf. Plate 4.

which are equally vital to its smooth functioning. In particular, the service systems of water and sewage are critically important. Most zoos report a high consumption of water. Quite apart from copious drinking supplies it is needed to keep cages and dens in a sanitary condition, for many are hosed out daily. For animals such as polar bears a bathing pool is a great asset, and of course for aquatic mammals and waterfowl it is essential. The circulation of water in artificial pools of this nature makes heavy demands on the piped water system. Similarly, a large capacity sewerage system is a prerequisite, and, in particular, the sanitary sewerage system, which has to carry waste from most enclosures, is a critical element.

Visitors' Comfort

The general public is the ultimate source of revenue for the zoo, either via the municipal tax structure or by paying entrance fees. The zoo planner must therefore do everything possible to encourage visitors and ensure their comfort so that they will want to return.

The first requirement is to facilitate the visitor's access to the zoo. A public transit service should run to the zoo from the city centre, and, for the car owner,

convenient parking space should be available. The latter requirement is becoming increasingly significant as private car ownership rises.

The growing reliance on mechanized transportation in Western society may have a long range implication for zoo planning. Traditionally zoos have demanded a high degree of activity from their visitors. They cater primarily for the pedestrian, in that the enclosures are more or less fixed in location, and in order to view them the visitor must move between the enclosures. In a few exceptional cases, such as the lion compound at Longleat, England, the exhibits are "free" while the visitor is "confined" within his car. The necessity of walking is thus removed. In most zoos, however, when a transportation system is used within a zoo it tends to be a compromise situation, usually requiring the dual use of pathways by vehicle and pedestrian alike. One such example is the San Diego Zoo which provides a guided bus tour along the chief pedestrian paths.

There are many disadvantages to such dual use. The safety and comfort of the pedestrians is compromised, while the nature of the paths is determined by the needs, not of the pedestrian, but of the vehicle. The zoo, therefore, should be planned either for pedestrians, in

which case an ancilliary (and separate) transport system may be devised, or for mechanized conveyances.

A fully mechanized zoo may well become desirable in the future. Already such a proposition is feasible, and the plans for a new zoo in Toronto visualize hundreds of acres of free-ranging animals which may be viewed only from a monorail.¹¹ An alternative approach might be a large scale "safari" amongst the animal enclosures, utilizing low speed electric vehicles, and requiring, undoubtedly, enormous areas of paving and parking. Problems of space, engineering and cost, however, preclude the adoption of such a scheme in a small community zoo.

Obviously, where space is restricted and finances limited, the zoo must be planned on the pedestrian scale. In any case, a zoo which is to make a contribution to outdoor recreation should not be dismissed in a half-hour ride. It should encourage the visitor to remain and explore, and to return on subsequent visits. In this way alone can its potential as a recreational asset be realized. Walking is appropriate for a zoo. Not only is it a more "natural" activity in a "natural" environment, but it is a healthy and enjoyable form of locomotion,

¹¹ R. Moriyama, Metropolitan Toronto Zoological Park, Glen Rouge, feasibility study and master development plan (Toronto, 1968), p. 4.

which is rarely practised by modern city dwellers.

Ritter points out that:

Today's towns discourage walking. Standards of safety are low. There is little which is picturesque. The air chokes and poisons. Car noises deafen and drown voices. Scale, surface, speeds are unsympathetic.¹²

The zoo, therefore, should cater for pedestrians, and make walking within its boundaries an enjoyable pastime. A fairly lengthy network of well-landscaped paths should exist, but the visitor should not necessarily be forced to take an extended walking tour. In general, therefore, paths should be routed so as to enable as many exhibits as possible to be viewed with the minimum of effort.

Innovations could be made, as at San Diego Zoo where travelators have been installed to transfer people up a steep hill.¹³ The measures taken, however, need not require such expenditure. Frequent rest areas are easily provided, and can be located in focal areas, perhaps near a small lake, or close to an enclosure of bears, monkeys or some other active animal. Facilities such as water fountains, refreshment kiosks, washrooms and restaurants should also be liberally distributed for the tired visitor's

¹²Paul Ritter, Planning for man and motor (Oxford: Pergamon Press, 1964), p. 38.

¹³"Moving sidewalks at San Diego Zoo," International Zoo Yearbook, II (1960), 61-2.

use. The special needs of children in these respects should also be catered for.

There are other ways in which the designer can counteract the visitor's weariness -- a state which has been equated to a feeling of ennui which tends to occur when the first excitement of the zoo has worn off. The Director of Colombo Zoo has been quoted as saying:

I don't like the common method of putting related species together in a group, you know, lions, tigers and leopards -- all the cats -- in one house or one section, primates in another and so on. People get bored. Children, especially, will stop looking after they've seen one or two cages of similar animals. I want to hold their interest. If you don't know what you might see next you keep on going. I like to show a few birds, then a couple of big cats, then some small mammals -- in other words, anything as long as it isn't the same thing in one cage after another.¹⁴

Variety, therefore, should be built into the layout. Faced with stereotyped rows of animals, the visitor will soon become bored. Frequent changes in the shapes of animals, sizes of enclosures, height of foliage, direction of movement, and even details like the texture of the pavement, help retain the visitor's interest. In a study of the characteristics of pedestrian movement, Simonds writes:

Slow motion engenders interest in detail. A man in a

¹⁴Emily Hahn, "A reporter at large," New Yorker, September 23rd, 1967, p. 102.

hurry tolerates no obstruction, but a man moving leisurely welcomes deflection and distraction. He has little interest in motion, and takes more pleasure instead in the things he can see or experience. He explores with all his senses, delights in relationships and is pleased by subtle transitions.¹⁵

The designer, therefore, has the opportunity to build into the circulation systems, a distribution which will afford constant interest and excitement, so that the pedestrian does not consider his weariness until an inviting rest area comes into view.

Thus the designer must be aware of the smallest details as well as the important generalities. He should take account of the views he creates, both in terms of distant vistas, and "close-ups" of the exhibits.¹⁶ Much emphasis, therefore, must be given to the landscaping of zoos. The vegetation provides an attractive backdrop to an enclosure; it moulds uniform areas of open space into distinct localities; it provides shelter from wind and sun, both for the animals and for their human spectators; and generally it plays a vital role in the creation of a tranquil environment.

¹⁵John Ormsbee Simonds, Landscape architecture (New York: McGraw Hill Book Co. Inc., 1961), p. 160.

¹⁶The photographic analogy is made advisedly, for the attractiveness of many places of recreation is judged not only by their immediate impact, but also by the impressions which may be taken away on film transparencies.

Orientation

There are few rules about the optimum size of a zoo. Doell suggests that an area of from 75 to 200 acres is required, but gives no reason for his standards.¹⁷ In reality zoos vary greatly in size. Bristol Zoo exhibits a wide range of animals on an area of 12 acres.¹⁸ Regent's Park Zoo is an institution of metropolitan character, encompassing an area of 36 acres¹⁹ while Bronx Zoo, its counterpart in New York covers 252 acres.²⁰ In general, though the virtues of compactness are recognized from the pedestrian's point of view, zoos tend to parallel Parkinson's Law, expanding to fill the space available, the obvious justification being the consequent improvement of space standards for the enclosed animals.

The result of such an attitude, while preferable from the zoologist's point of view, has the effect of attenuating the layout. The visitor, as a consequence, is more likely to get lost or disoriented in the labyrinthine

¹⁷ Charles E. Doell, Elements of park and recreation administration (Minneapolis: Burgess Printing Co., 1963), p. 171.; The same standard is cited in Arthur T. Wilcox, ed., A zoological park, Why, Where, How (East Lansing, Mich.: Michigan State University, n.d.), p. 12.

¹⁸ Bristol Zoo Book and Guide (Bristol: The Bristol, Clifton and West of England Zoological Society, n.d.), p. 6.

¹⁹ London Zoo, Regent's Park, publicity leaflet, n.d.

²⁰ Bronx Zoo, publicity leaflet, n.d.

pathways. He has no ordered concept of the total layout, and cannot plan and follow a route. He may pass an exhibit several times and miss others entirely. In Bristol Zoo, which covers a total of 12 acres, the plan is based on a single circuit with most buildings on the periphery, yet people often complain of being unable to find a particular group of exhibits.²¹ The effect is multiplied in zoos covering a larger area. Most zoos provide simplified maps for their visitors, but the necessity for constant reference to maps or signposts so as to keep to a pre-ordained route is anathema to the idea of relaxation expected in the zoo. When the layout lacks a certain imageability, it has failed. Simonds cites an example which may be readily equated with a large and complex zoo:

It is generally conceded that in terms of its plan layout the Chicago World's Fair of 1933 was a failure. It was simply too vast, too sprawling and too disorganized. The fairgoer entering its gates felt overwhelmed, which was desirable in some respects; but he also felt confused which was not. The visitor sought direction and points of orientation; he wanted to know where he was going and how he might return. Seeking a particular exhibit, he wanted to know how best to get there. Finding himself in any one area of the fairgrounds he wanted to know his relationship to the other fairground areas, the features and the gates. He wanted, simply, to understand the fair's plan and relate himself to it. Frustrated in this he felt confused and lost, and often didn't pay a return visit.²²

²¹Bristol Zoo Book and Guide, p. 14.

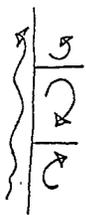
²²Simonds, Landscape architecture, p. 128.

The fair, like many large zoos, lacked identity.

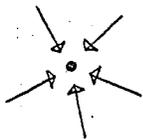
Kevin Lynch summarized the identity of cities in five general categories which, together, give them imageability -- a feeling of orientation on the part of the city dweller.²³ His ideas might well be applied to the design of a zoo layout, in an attempt to avoid the situation quoted above.



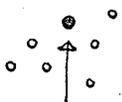
"Paths", in Lynch's terms, are the pedestrian routes, which may be designed so as to aid orientation.



Distinct "edges" are formed by the barriers between the public, the enclosures and the service areas.

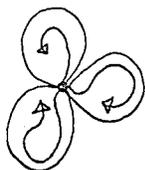


"Nodes" are the places where people stop and linger -- at the cages of the more popular animals, at cafes, kiosks and the rest areas.



"Landmarks" are essential orientation points -- buildings, flagpoles or an outstanding topographic feature.

²³Kevin Lynch, The image of the city (Cambridge, Mass.: Massachusetts Institute of Technology Press, 1964), pp. 46-90.



"Districts", might be formed by placing animals in some distinct groupings which would be recognisable to the visitor.

These different elements of space manipulation may be used by the zoo designer to give clarity to the spaces that he moulds, and so make the experience more comprehensible for the visitor. Out of a labyrinth of paths and exhibits it should be possible to proceed intuitively and be fairly certain of missing nothing. In some cases, therefore, it may be advisable for the designer to predetermine the sequence of confrontation of viewer and exhibit. One way of doing this is by means of prescribed routeways. These need not be so rigid that the viewer cannot escape the pre-ordained channel, but a certain element of control may be welcomed by the visitor who feels somewhat daunted at the prospect of 100 acres of unknown ground. The responsibility of the designer was defined by Gardner and Heller:

The planner of an exhibition attempts to foresee people's behaviour and predict where they will hurry, stop, look or drift on. His aim is to control the flow and arrest it where he wants; but controlling the flow does not mean that people are to be moved along predestinate grooves like trains, or shuffled round hurdles like sheep. Ideally the planner is aiming to direct people's movement in such a way that they see what there is to see with ease and in their own time. He must also ensure that the public does not get lost, tired or bored with

the whole affair.²⁴

The zoo, therefore, should be an ordered environment, but should not, as a result, forfeit any of its informality as an area of free circulation.

One means of establishing orientation in a zoo layout is to link the pedestrian paths with distinct groups of animals. Such an ordering is rare in zoos, but has the advantage of giving each path an individual identity. For example, an ecological approach enables the isolation of distinct areas (or "districts" in Lynch's terminology) within which all the exhibits have an easily definable relationship. Thus, the animal collection might be considered as a combination of biological communities or biomes. The available area might be divided for presentation purposes, into communities from prairie, desert, riverine, arctic, tropic or temperate environments.

Alternatively, the animals might be divided into family groups -- felidae, canidae, ursidae and so on. This approach has been adopted fairly successfully in San Diego Zoo, but has the inherent weakness that a succession of similar animals quickly becomes tedious.

A third alternative is to divide the zoo into a

²⁴James Gardner and Caroline Heller, Exhibition and display (New York: F.W. Dodge Corporation, 1960), p. 33.

series of continental areas, each exhibiting indigenous animals. This system ensures a variety of animal types in sequence. The "continents", or basic units of subdivision, form "districts", each with its own identity, and each of which may be viewed as an entity, fitting into the larger context of the "world" as represented by the zoo.

Education

Most zoo directors are aware of the advantages resulting from the adoption of formal education schemes, such as an arrangement with local schools or youth clubs to provide guided tours or informative leaflets. A further innovation, often as a preliminary to a guided tour, is an illustrated lecture by a zoo official. Many zoos, therefore, include a small auditorium in their plans, and where the objective is a comprehensive educational scheme, classrooms and library may be added to the building.

The zoo has other, less formal responsibilities. People rarely visit a zoo purely for their education. They go primarily to enjoy themselves, but are not averse to a little incidental learning. John Barr writes:

While for many people, a visit to the zoo is nothing more than a nice day's outing, especially for the kiddies, most zoo directors believe that, particularly

nowadays, education plays a big part: as one zoo man puts it, "Even uneducated parents sense subconsciously that their children will learn something useful."²⁵

The accepted method of passing on information about the exhibits is the provision of signs at each enclosure, stating the animal's species, place of origin, habitat and so on. This information is there for those who seek it. There has recently been a move to increase the impact of these signs by employing a more eye-catching approach. Bronx Zoo, for example, has made great efforts to add colour or bulk to their signs so as to attract attention.²⁶ A reasonably large sign is likely to be read, and, if well positioned and executed, will not detract from an otherwise "natural" exhibit.

A feature of most zoos, the Children's Zoo, often has an educational bias. Though many exhibits are chosen because they are "cute" and "cuddly", and may in fact encourage an anthropomorphic attitude, they aim at increasing a child's tolerance of animals, by permitting him to touch them, and examine them at close quarters. Usually at least one keeper remains on duty here, to answer queries.

One approach to the problem of providing an educational

²⁵Barr, "Our beastly pleasures," p. 945.

²⁶William Bridges, "Informative signs in the zoo," International Zoo Yearbook, IV (1962), 150.

environment in the zoo is the use of museum collections to supplement the animal exhibits. While zoos have often been likened to museums and have even been built adjacent to museums, there has to date been little interest in integrating the two. One of the few applications of this principle is in Fort Worth Zoo's aquarium and herpetarium, where:

Decorative mobiles with appropriate maps introduce the visitor to each hall and selected artifacts from the countries involved enhance the atmosphere of the continental theme.²⁷

Animal houses might be designed to incorporate relevant inanimate exhibits, to add to the visitor's knowledge and understanding of the animals. An exhibition of antlers or comparative bone structures would be one approach.

Occasionally an attempt is made to place animals in their geographic context. In heated houses like a reptilium, the cages are provided with exotic plants, in order to reproduce the lush vegetation of the animals' native habitat. In a few zoos this approach is adopted on a larger scale. Los Angeles Zoo, for example, makes a policy of exhibiting animals in continental areas, each of which

²⁷Lawrence Curtis, "The aquarium and herpetarium at the Fort Worth Zoological Park," International Zoo Yearbook, IV (1962), 47.

"contains plants native to that particular region of the world."²⁸

Where an extreme climate prohibits the use of non-native planting, the grouping of animals according to their type of habitat or continent of origin helps to establish the links between them. Many zoo directors agree that:

If the animals displayed are confined to native species or to those of a contiguous zoo-geographical area the educational value of the collection is greatly enhanced.²⁹

There is, in fact, a trend in many of the newer zoos to establish such an ordering.

Maximize Use

A zoo is not an inexpensive addition to a community. The purchase and maintenance of the animals and the construction and upkeep of their enclosures involve considerable expenditure. A zoo, therefore, should be planned as an extension of urban living space, rather than as an amenity for out of town visitors. It should warrant repeated visits and sustained interest from the people of the community. In most cases, zoos have a strictly seasonal appeal. Bad weather is the

²⁸ Los Angeles Zoo, publicity leaflet.

²⁹ P. Wayne, "The role of the wildlife park in nature conservation," International Zoo Yearbook, VII (1967), 232.

obvious cause of a marked decline in numbers of visitors during the winter months.³⁰ Paradoxically, however, this decline coincides with the period when trips out of town are at a minimum and when urban recreation facilities should be used to the utmost. A zoo is a good example of a recreation amenity which can never shut down. Apart from hibernating species the animals are still active in winter, though largely confined indoors.

In areas, therefore, where the winter climate is severe, a zoo should be planned with the intention of encouraging winter use. Many zoo animals must be provided with heated indoor quarters. These tend to be concentrated in a few large buildings so as to minimize heating costs and facilitate the keepers' work. Each building, therefore, could be designed with a large and attractive public area. Informative signs, photographs and "museum" exhibits could be arranged so as to sustain visitor interest, while benches could be provided near the cages of the more active animals. Several buildings could be situated in close proximity so that a series of houses could be visited with the minimum contact

³⁰ Attendance figures for Assiniboine Park Zoo, Winnipeg in 1968;

January.....8,588	February....9,578	March.....39,318
April.....87,738	May.....140,001	June.....217,886
July.....191,006	August....146,862	September..86,098
October....49,566	November...19,201	December...16,196

Personal communication with Dr. G. Voss, Director of Assiniboine Park Zoo, Winnipeg.

with the weather. Ideally some form of heated passageway should be provided between neighbouring houses. It may be possible during construction stages to institute a system of tunnels between buildings. Alternatively, a covered walkway could be installed at ground level for the duration of the winter months. A good restaurant situated close to parking facilities, and linked with the heated circuit would encourage prolonged visits to the zoo.

Of course, not all animals require heated shelters. Certain mammals including most hoofed stock and arctic fauna can withstand extreme cold, and may be viewed outdoors in sub-zero weather. While few people apparently relish the prospect of visiting a strictly "outdoor" zoo in winter, it is possible that some may be tempted outside for a short while if there are adequately heated spaces to return to afterwards.

Certain special steps may also be taken to increase the zoo's attraction in cold weather, varying from formal lectures or illustrated talks in the auditorium, to the installation of some kind of mechanized conveyance to improve the viewing conditions outdoors.

Development Stages

As already indicated, a zoo plan must take account of the potential long-term development of a site, as well

as the growth which the community is currently able to sustain. Some thought must be given to the staging of development, to ensure that the growth follows an orderly pattern. Ideally the zoo would have, at any intermediate stage, all the attributes of functional separation, imageability, all-season use and general attractiveness of the final entity.

Part Two

Chapter 5

Saskatoon Zoo - Opportunity

The preceding chapters have attempted to define the various criteria which should be considered when a zoo is being planned. Inevitably such criteria may have limited application, for zoos are established only infrequently, and often have such humble beginnings that the most rudimentary plan suffices. The real challenge of a zoo may not be faced until the nucleus has been established.

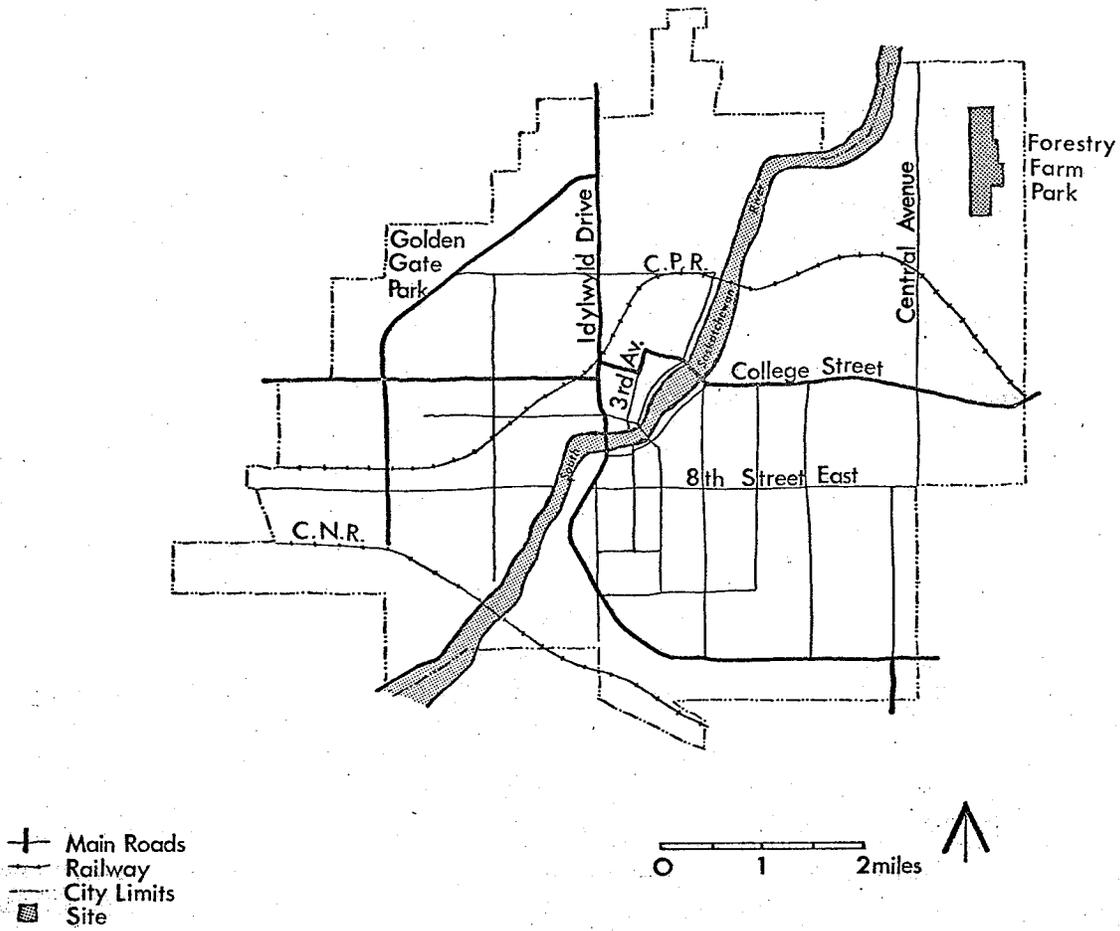
As a result of several fortuitous incidents, the city of Saskatoon, Saskatchewan, is currently faced with the opportunity of founding its own municipal zoo. The site, some of the animals, and more importantly, the backing of the general public have already been obtained, and the construction of animal shelters is to begin in the summer

of 1969. It is to be hoped that the immediacy of the demand for a zoo will not be allowed to detract from the long-range potential of the amenity. The remainder of this thesis, therefore, will be devoted to a discussion of the possibilities offered by the site, and a proposal of a layout which is both immediately feasible, and which will form part of an integrated whole when the zoo inevitably expands.

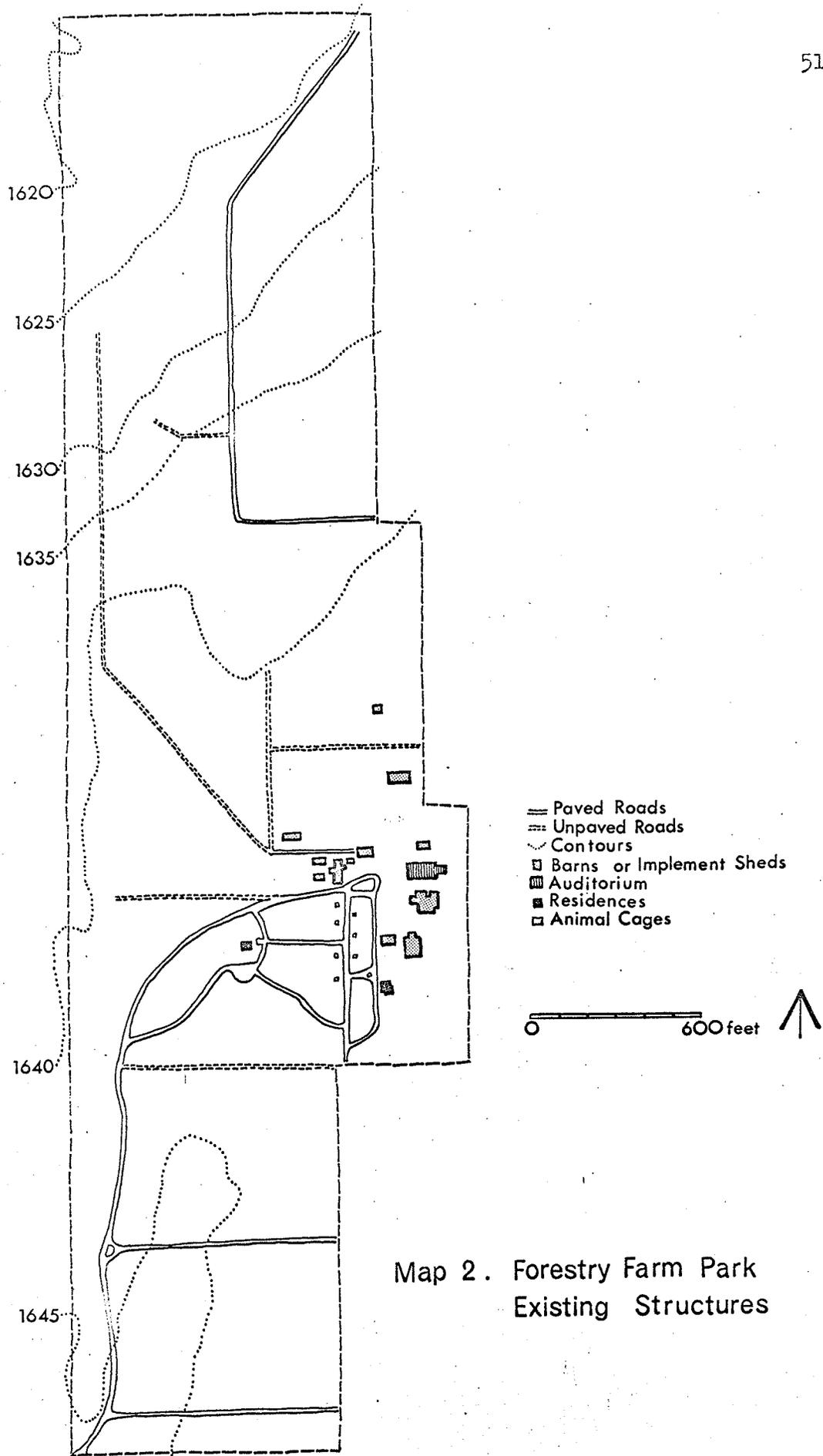
Site

The site on which the city authorities currently propose to establish a zoo was, until several years ago, part of a Prairie Farm Rehabilitation Administration experimental forestry farm on the outskirts of Saskatoon. When the western section of the farm was declared surplus by the P.F.R.A. it was offered to the city for a nominal charge, "on condition that it was maintained for public purposes."¹ The Forestry Farm Park contains some attractive lawns and plantings in its southern portions and is presently used as a public park, though it has few facilities apart from picnic lawns, a small auditorium, some rudimentary open air sports facilities and a few primitive cages housing some small indigenous

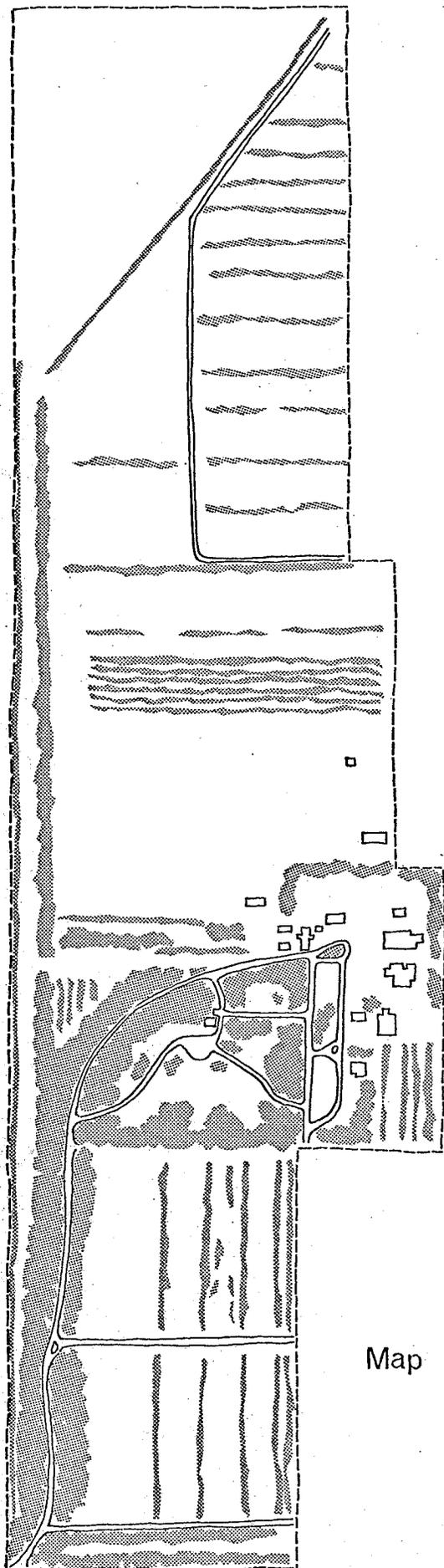
¹Personal correspondence with Mr. H.E. Wellman, Building Director and City Planner, Saskatoon, to whom the author is indebted for much of the relevant information in this section.



Map 1 . Location of Site in Saskatoon



Map 2. Forestry Farm Park
Existing Structures



Map 3. Forestry Farm Park Plantings

mammals. (Maps 2 & 3) To date, the park has involved little municipal expenditure. However, a proposal has been made to extend the use of the park by developing its northern area as a zoo.

Exhibits

The few animals already on the site could be regarded as the nucleus of a future animal collection. These are to be augmented by a group of larger native species which were collected by a private individual and exhibited on a site close to the city. The "Golden Gate Animal Park" was a marginal enterprise, involving low investment in animal shelters and public facilities and was never a financial success. As a result, the animals were offered to the city which bought the exhibits and, as a temporary measure, arranged for an annual lease on their accommodation.

Public Interest

In the course of these negotiations various school, university and public groups became interested in the possibility of establishing a municipal zoo and these bodies exerted pressure on the City Council to take advantage of

the opportunities offered. As a result, the animals were purchased and a portion of the parks budget was set aside (\$ 50,000 annually) to cover the zoo's initial expenses. An informal zoo committee has recently been established, consisting of the City Commissioner, City Planner, City Engineer, various representatives from Parks and Recreation bodies, and a student of Veterinary Surgery at the University of Saskatoon, and preliminary investigations of the zoo site have begun.

Practicality

The decision to establish a zoo in Saskatoon was arrived at more or less fortuitously. The immediate nature of the problem of housing the animals now in the city's possession, however, does not detract from the advisability of establishing a zoo in this community. The city is already large enough to maintain an adequate zoo,² and the population growth over the ten year period preceding 1966 shows a rapidly urbanizing trend which can only lend support to the demand for improved recreation facilities in the city.³

²William Bridges, Promoting a zoo in cities under 100,000 population, Mimeographed copy of paper presented at A.A.Z.P.A. Convention, September, 1955.

³Population statistics for Saskatoon in recent years are; 1956 -- 72,858 : 1961 -- 95,526 : 1966 -- 115,892 ; Dominion Bureau of Statistics, Census of Canada (Ottawa: Queen's Printer, 1956-61-66).

Another factor encouraging the careful consideration of zoo policies is the fact that the area around Saskatoon is poorly endowed with outdoor recreation amenities. A recent study of the city's recreation requirements "substantiates the demand for essentially local facilities,"⁴ the reason being that:

Saskatoon is poorly located with respect to high quality recreation lands and has only one, and that an inferior, provincial park within an hour's driving distance.⁵

An estimate of patrons of commercial recreation outlets, excluding drive-in theatres, drag-strips and restaurants, totalled 200,000 per season compared with 375,000 and 223,000 visitors to Moose Mountain and Echo Valley Provincial Parks in the same season, indicating a considerable demand for strictly urban recreation outlets.⁶

Thus, many factors combine to create a demand for a zoo in Saskatoon. The city is fortunate in having an unencumbered site immediately available, as well as the animals for display, and it would be easy to design a layout

⁴J. Howard Richards, "Gross aspects of planning and outdoor recreation with particular reference to Saskatchewan," Canadian Geographer, XI (February, 1967), 119.

⁵Ibid.

⁶Ibid.

in keeping with an essentially small scale concept. In view of the rising demand for recreation which may be expected in the future, especially in a city growing as rapidly as Saskatoon, such a short-sighted approach would be unfortunate.⁷

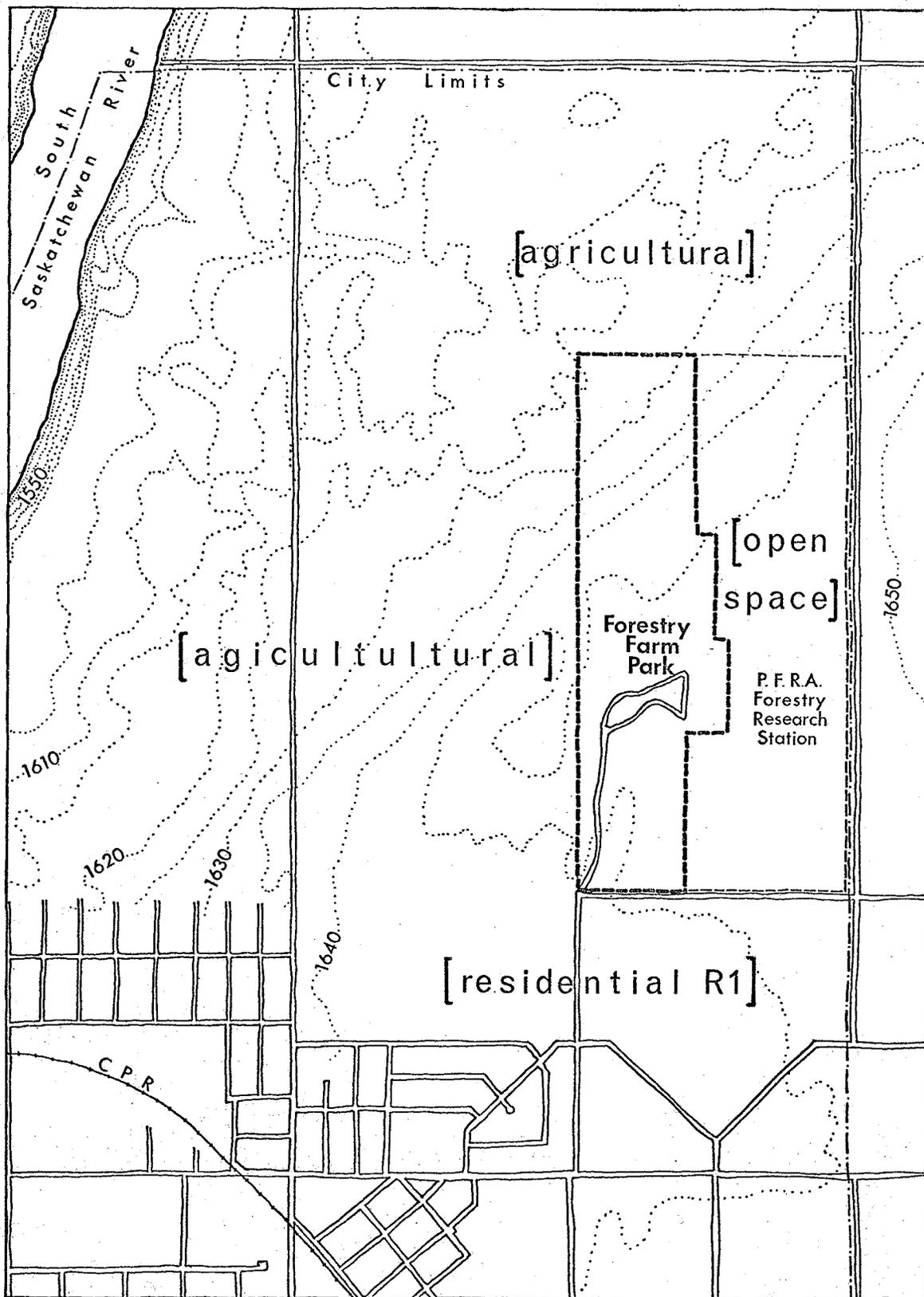
⁷During the twenty year period between 1946 and 1966 the population of Saskatoon increased by 136%. At this rate of growth the population in 1986 would be 273,500.

Chapter 6

Saskatoon Zoo - Site Characteristics

Location

The Forestry Farm Park is located at the north-east perimeter of the city in an area of mainly undeveloped land, at a distance of about four miles from the city centre (Map 4). East of the site a small P.F.R.A. station is devoted to experimental horticultural plots. There is a possibility that eventually this land, like the present Forestry Farm Park, will be offered to the city. Property further to the east is outside the city limits and is used for agriculture. Land to the north is marginal farm land, while the area to the west is owned by the University of Saskatoon and is used for experimental pasturage. South of the Forestry Farm the property is designated for residential development whenever the pressure for growth requires it.



Map 4 . Neighbouring Land Use



- City Limits
- Forestry Farm Park
- P.F.R.A. Station
- Contours
- [] Proposed Zoning

Thus, none of the adjacent land uses is incompatible with the purposes of recreation as embodied in a zoo. It is conceivable that northerly winds might carry unpleasant sounds and odours towards the area zoned for residential development, but under present conditions a "buffer strip" of parkland almost half a mile deep separates the zoo from proposed residential areas. It is probable that, far from discouraging residential development in this area, a zoo would attract residents to its vicinity.

Present Use

The Forestry Farm site encompasses an area of 142 acres, about half of which is presently developed with lawns, plantings and some functional buildings (Maps 2 & 3). Though out of keeping with the atmosphere of a public park, most of the structures are in good condition and consequently have been retained. They include packing and implement sheds, greenhouses, granaries, barns, a garage, an auditorium and two dwellings.

Vegetation

Some of the tree growth is well established, and forms one of the chief attractions of the area. The trees

bordering the avenue, for example, form an impressive feature which should not be disturbed. Most of the plantings introduced by the Forestry personnel, however, were in neat, but unnatural rows which do not adapt easily to the requirements of a public park (Map 3). In a Prairie city like Saskatoon, where the natural vegetation is restricted in character, it is generally undesirable to disturb any established growth. In landscaping the park, however, it will undoubtedly be necessary to transplant much of the introduced growth. Wherever possible such disruption should be kept to a minimum as one of the chief problems in landscaping will be the encouragement of sufficient trees and shrubs.

Topography

The need for adequate vegetation cover, in both quality and quantity, is particularly significant because of the lack of topographic character on the site. The land is more or less flat, with a slight slope towards the northwest (Map 4). In the distance of one mile from the southern entrance to the northern boundary there is a drop in elevation of only 20 feet. The relative flatness of the site poses some problems. A zoo should be an attractive environment,

and where all attention is focused on the horizontal plane it can quickly become tedious. Visual interest, therefore, must be created artificially, both by skilful use of vegetation to create a third dimension, and by moving sufficient earth to build a few artificial hills.

Drainage

A further problem imposed by the topography concerns drainage. This factor is of particular significance in a zoo which usually requires a large and complex system of sanitary and storm sewers. The existing sewer system on the site links with the main line to the south of the park. Development in the north will require the installation of a new feeder line, as well as the construction of a lift station. Since the slope of the land is away from the main sewer line, any expansion close to the northern boundary may require further expensive measures to raise the flow to a sufficient height. This factor, therefore must be given consideration when the pattern of future growth is determined. A long-term solution to such engineering problems should be investigated before the location and capacity of an expensive installation such as a lift station are determined.

Surface drainage is less likely to pose a problem.

The slope of the land continues gradually towards the South Saskatchewan River, about a mile to the west. Soils in the area are generally light loams developed on glacial till deposits and their tendency to become rocky at depth aids drainage. The surface will not tend to become muddy or sticky, a condition which is considered disadvantageous in a zoo.¹

Climate

Perhaps the environmental factor of most significance in the development of a zoo for Saskatoon is the climate (see Appendix). The dramatic contrast between summer and winter temperatures in particular imposes many limitations on zoo design, from the point of view of both the animals and the visitors. The extreme cold of winter, intensified by the "Exceptional . . . strength of the winds from all directions and at all seasons at Saskatoon"² requires that all animals, apart from the hardiest high latitude species, spend a large part of the year indoors. Those that remain out of doors must be provided with well sheltered enclosures

¹P. Wayne, "The role of the wildlife park in nature conservation," International Zoo Yearbook, VII (1967), 232.

²W.G. Kendrew and B.W. Currie, The climate of Central Canada (Ottawa: Queen's Printer, 1955), p. 123.

through the use of fences or shelter belts.

Another problem imposed by climate is snowfall.

The wind tends to form the snow into drifts which can quickly fill a moat and render it useless as a barrier. As a result very deep moats may have to be constructed, and fences, either temporary or permanent may have to be considered in the design of some enclosures.

The main advantages of the Saskatoon climate are the low humidity, which tends to modify the severity of temperature extremes, and the fine summer weather which generally tends to encourage outdoor recreation.

Chapter 7

Saskatoon Zoo - Concept

The design of a layout involves the application of a set of general principles, as set out in Part I of this thesis, to a particular set of site conditions as described in the previous chapter. Before a detailed plan can be drawn up, however, a set of principles must be determined to apply specifically to Saskatoon. The city's size, location and the character of the site are all determinants of the planning goals set out below.

The park should cater for the pedestrian

The scale of the zoo should relate to the scale of the community. Saskatoon Zoo is necessary more as a recreational

outlet for the citizens of Saskatoon than as a major tourist attraction. It should aim at bringing "outdoors" to the urbanite, by providing a series of pedestrian pathways which the visitor can explore at his own speed, rather than attempting to provide a quick "package tour" by bus, car or monorail. In most cases, therefore, enclosures will be limited in size to ensure easy viewing of the animals.

Pedestrian -- vehicle separation is necessary

Where the design emphasis is placed on the quality of the pedestrian area, its character must not be determined by vehicular requirements. Pedestrian paths should be designed as organic channels responding to the spaces they traverse. Stretches may be broad and curving, long and narrow, twisted or braided, like the path of a stream. Vehicular movement requires separate, and generally secondary, treatment. Trucks should not be allowed to interfere with the pedestrian's enjoyment of the zoo.

The zoo should have a strong core area

This would serve as a reference point to the

pedestrian, and facilitate orientation. Some of the more expensive structures could be built in close proximity and linked by heated corridors to enable winter viewing with minimum discomfort. The core should be close to parking facilities.

Paths should have order and identity

The core should be the nucleus for a series of pedestrian paths, and they should be linked in a relationship which is readily identifiable, rather than randomly criss-crossed. A suitable means of ensuring order and identity is the division of the exhibits into a few broad categories or "districts" to which the different pedestrian systems can be related. "Continental" subdivisions should preferably be chosen, as this solution offers the greatest variety of animals in the early stages. A suitable division is North America, South America, Australasia, Africa and Eurasia.

The site should be "sculptured" to provide interest

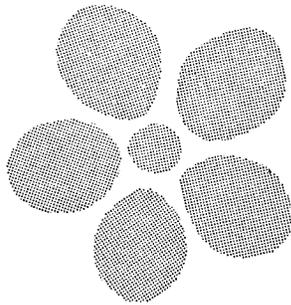
The flat landscape must not be allowed to dominate

the layout. Views should be fore-shortened and channeled by the curvature of paths and the skilful use of artificial mounds, and mass plantings to give verticality.

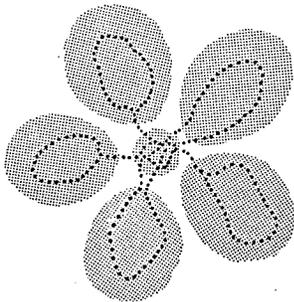
The plan should be considered as a series of stages

While the immediate need should be catered for, it must not jeopardize future growth.

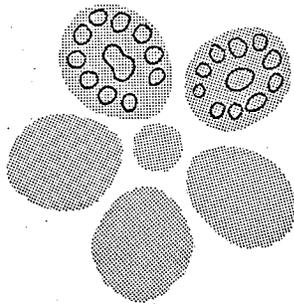
A Model for Saskatoon Zoo



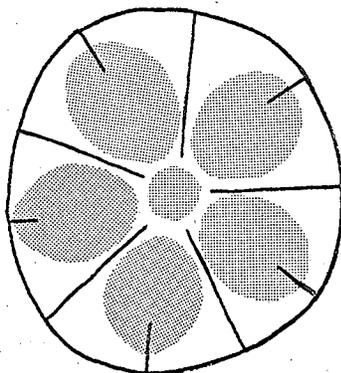
"Continental" areas, or sets of enclosures, radiate from a central core.



Pedestrian paths weave through the "continents" and dominate the core.

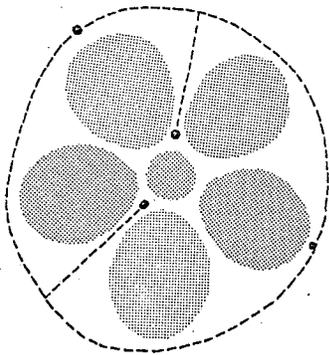


Separate enclosures occupy the perimeter of each "continental" circuit. The centre is devoted to a large paddock enclosing a group of compatible animals.

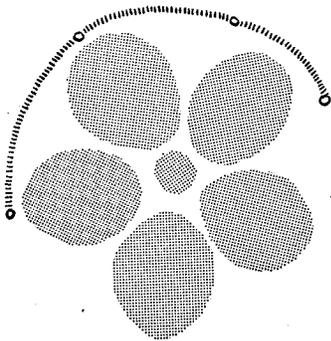


Maintenance routes are separate from pedestrian paths. The circulation system is based on a perimeter road with feeder roads extending into the core. Where these cross pedestrian paths to gain

access to the free range paddocks servicing should be completed before the zoo is opened to the public.

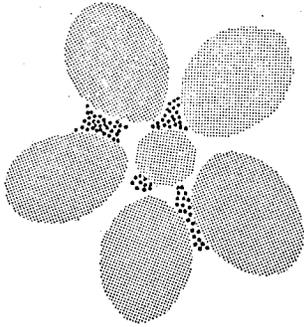


Facilities for visitors, including restaurants, kiosks and washrooms, should be serviced from maintenance routes.

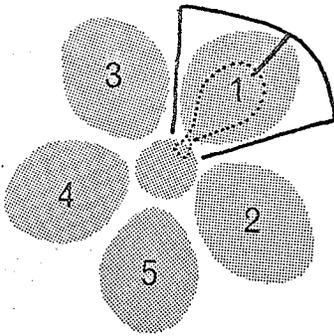


Provision may be made for a public transit system across or around the zoo. This should not be allowed to encroach on pedestrian paths (except in the situation that a whole "continent" is given over to some sort of trackless train, and no pedestrian traffic is permitted).

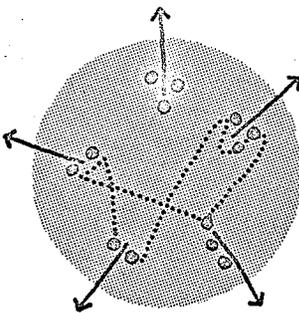
Generally, maintenance corridors must be used, and some thought should therefore go into the landscaping of these. Rides around the periphery could be organized on a conveyor belt system, with stops at each "continent" and at car parks.



Apart from pathways, provision should be made in the interstices between the "continents" and in the core, for public lawns and open spaces.



Development may be planned in five stages, each representing a "continent" with its attendant pedestrian paths, service routes and core structures. During the early stages it may be necessary to treat each "continent" rather as an ecological unit, if species are obtained which do not fit the existing "continental" pattern. Strict geographical division, therefore, may not be required until after the completion of the final stage.



Orderly development in this fashion will facilitate servicing in all parts of the zoo, including the core, where the principal buildings would be constructed on the service routes.

Chapter 8

Saskatoon Zoo - Layout

There are no absolute rules about the optimum size of a zoo apart from Doell's suggested standards, requiring an area between 75 and 200 acres.¹ In the case of Saskatoon, the total acreage of the site under review is 142 acres, and falls well within the postulated range. While it is understood that only the northern half of the site is currently being considered for development it is evident that if the zoo flourishes and so expands it could occupy the entire site. For this reason the southern half of the Forestry Farm has been included in the long term plans. The facilities in the southern area are somewhat haphazard in nature, and while they have an obvious attraction at present they should eventually

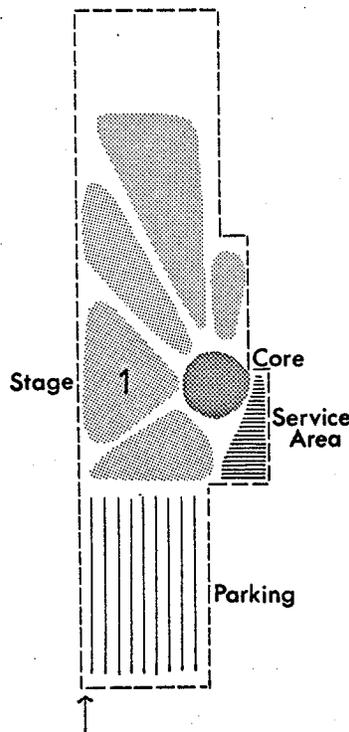
¹Charles E. Doell, Elements of park and recreation administration (Minneapolis: Burgess Printing Co., 1963), p. 171.

form part of a more carefully planned park. At present, however, they serve a useful purpose and it is felt, therefore, that the first stages of the zoo should be confined to the north of the site.

In view of the high cost of establishing a zoo, every attempt has been made to produce a plan which will minimize initial expenditures. Access from the south, for example, is an accepted limitation. It will affect the layout in the early stages. In any case, the existing driveway, being lined with mature trees, is worth retaining. At the east of the site are some buildings -- sheds, barns and glass-houses, built by P.F.R.A.. Some of these are in good condition and could be retained to form the nucleus of a service core. They are well located, being at the end of the existing road, and partly cut off from the rest of the site by a shelter belt. In addition, these buildings are situated at the broadest part of the site, and so the utilization of this area for a service core would not tend to bisect the site.

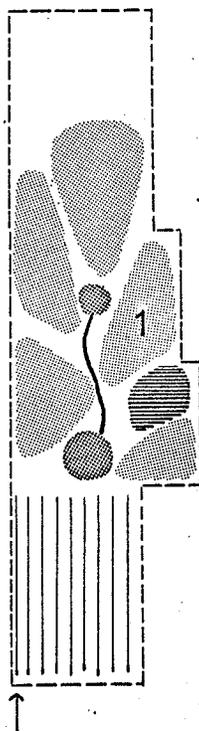
With these facts in mind, an attempt was made to adapt the theoretical concept described in Chapter 7 to the Forestry Farm site. The elongated character of the site necessitated some major revisions in the original concept, and several alternative solutions were found.

Alternative 1



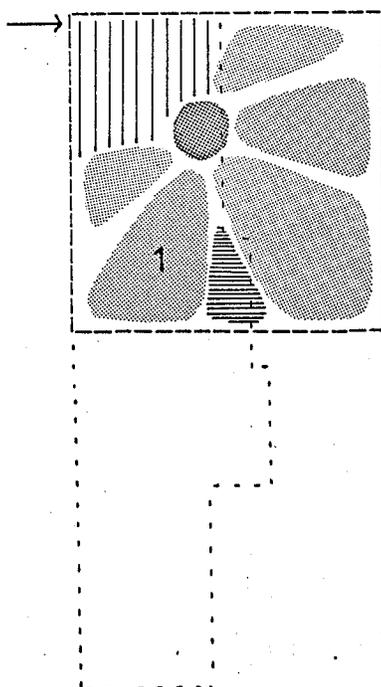
The core is located west of the service area with elongated "continents" radiating from it. This plan retains a high degree of centrality but makes unsatisfactory use of the land available. The "continents" are too attenuated in shape to form satisfactory units. The first stage is not cohesive and the core is too far from parking at all stages. A parking lot in the south acts as a buffer between the zoo and the neighbouring residential area.

Alternative 2



This plan shows an awareness of the linear nature of the site. A small "winterized" core at the south is linked to a secondary core by an important arterial route from which the "continents" radiate. The first stage can be developed as an entity. However, there is still a problem of distance from the parking area, especially in the early stages.

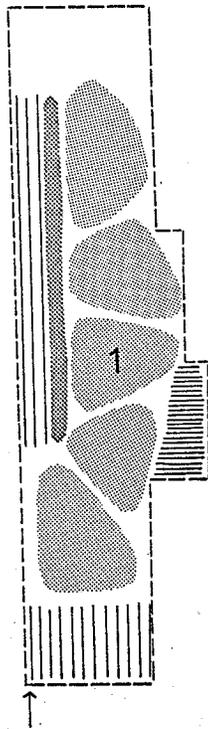
Alternative 3



The drawback of an excessively elongated site might be sidestepped in the event that an arrangement could be made with P.F.R.A. to acquire the northern half of the present research station to the east of the park for expansion, and so obtain all the benefits of compactness. A road allowance to the west might be developed to attain access to the parking area which would extend close to the core. However, this solution relates less well to existing facilities in the southern part of the site -- a factor which would be especially significant in the early stages of development. It would also be impractical to begin such a scheme without absolute assurance that the remainder of the land would ultimately belong to the city.²

²It is expected that this area will become city property eventually -- Mr. H.E. Wellman, Building Director and City Planner, Saskatoon, in personal correspondence.

Alternative 4



The major weakness of the previous alternatives is the distance separating the winterized core and the parking lot, especially in the early stages. This drawback can be overcome by utilizing the linear nature of the site to establish an elongated parking lot along the western boundary of the site. The core is likewise elongated and attenuated, and runs parallel to the parking lot, from which the heated houses are readily accessible. A continuous heated corridor links the main buildings at the edge of the zoo where it cannot disrupt pedestrian paths. Visitors would have access to the heated corridor at several points since each "continent" would have a gate. The parking lot should not extend south to the road, as this would disrupt some of the best trees in the area. In any case, there should be a parking lot at the south to act as a buffer between the zoo and the residential area.

Such linear development is appropriate

from an engineering viewpoint for the drainage of such an elongated area requires a similar approach (with a main collector system running from north to south along the western periphery, joined by short east-west laterals which could be aligned along the maintenance pathways).

Primarily, this solution is attractive because it forms a cohesive and climatically satisfactory unit from the earliest stages, without conflicting unnecessarily with the present development.

Of the several alternatives described, this system of development was considered the most satisfactory. It was, therefore, chosen as the model for the layout of the first stage of Saskatoon Zoo.

Chapter 9

Saskatoon Zoo - Stage 1

A first stage layout has been designed which will conform with Saskatoon's requirements in the immediate future (see Plan in pocket). Covering an area of about 20 acres, it forms a cohesive unit, but may readily be expanded when funds become available.

Animals

The city authorities already own a number of native animals. Since indigenous species are easily obtained, and are not difficult to house they will tend to predominate in the early stages of the zoo. Therefore, the first stage is planned as the North American "continent". In order to

introduce some exotic wild life, however, part of the African "continent" will be constructed simultaneously.

Maintenance

The service core is located in the east of the site, in an area which has a predominantly functional character at present. It is recommended that the buildings north of the main avenue and the auditorium be utilized initially (for example, greenhouse, garage and barns). Other buildings, including offices and commissary will have to be constructed.

A service road encircles the zoo. (In later stages this would be truncated towards the west to allow free pedestrian circulation from one "continent" to another.) Most animal houses and paddocks can be serviced from this route and from special bays leading from the parking lot. The only exceptions are the deer enclosures, the bear pits and the seal pool. In these cases it is recommended that part of the pedestrian path be made wide enough to carry a truck, but that such vehicular use should preferably be at times when the zoo is closed to the public.

A separate access route from the main road to the service core should be constructed along the eastern boundary of the site.

Public Access

The Forestry Farm Park is located at some distance from the centre of Saskatoon, and is at present accessible only to car owners. When it becomes the location of the municipal zoo, the park should be served by the public transit system. A bus terminus could be located close to the zoo entrance, enabling passengers to disembark beneath a canopy, and go directly into the heated core area. The canopy extends for some distance along the main entrance building, so that it can be used simultaneously by visitors arriving by car.

Since there will be a tendency for motorists to proceed from the main driveway to the entrance structure before parking, it would be advisable to institute a one-way circulation system in the parking area. This will be particularly necessary in later stages when several entrances will open on to an elongated parking area.

The present access road through the Forestry Farm Park is winding and attractive. While it can at present accommodate traffic in two directions, increasing volumes of traffic may eventually necessitate the construction of a new access (or exit) route to the west of the site, and the institution of a one-way circulation system throughout.

The parking area indicated on the plan can accommodate

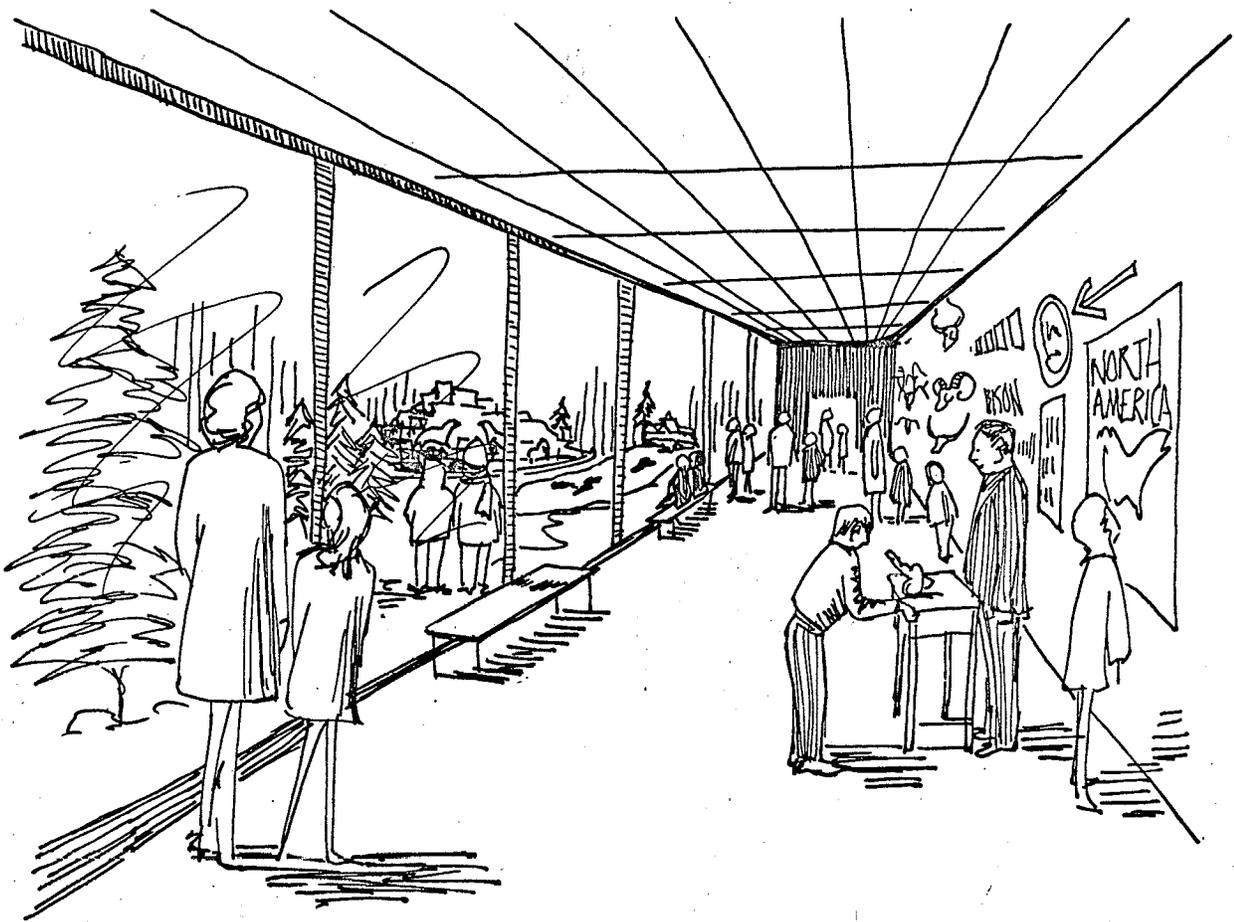
about 700 automobiles. This allowance is likely to be quite adequate in the earliest stages. If necessary, however, the parking lot could be extended northward, independently of development within the zoo.

Heated Core

The main entrance should be an impressive structure, both as seen from the parking lot and from inside the zoo, where it will serve as a useful landmark. The entrance hall incorporates an office, a shop, cloakroom, first aid post, washrooms, nursery, and so on. A tower constructed at this point would be an attraction, affording views over the zoo which would not otherwise be possible.

Adjacent to the entrance is an education complex, with study rooms, library and an auditorium. At the other side of the entrance is a restaurant with outdoor cafeteria service on the ground floor in summer. The entrance hall and patio should be slightly elevated to improve the visitor's view of the zoo panorama as he enters the zoo.

To the north of the restaurant, and linked with it in the heated corridor system are an aviary, small mammal house, monkey enclosure and a lion house to which an extension may later be built. South of the auditorium the small cats house is also linked to the heated system.



A corridor in the heated core.

In this way, movement from one house to another is facilitated, without imposing restrictions on summer time circulation. The heated corridor should have glass walls overlooking the zoo, and might incorporate a small inanimate zoological display.

Circulation

In designing the circulation system an effort has been made to ensure easy orientation without imposing a limited circuit of pre-ordained routes on the visitor. In general, the more expensive structures have been confined to the western half of the layout, where they will be viewed by the greatest number of people. Here the layout is less deterministic, and the paths wind at random between the enclosures. Thus, the less energetic visitor can see the most impressive exhibits with a minimum of effort.

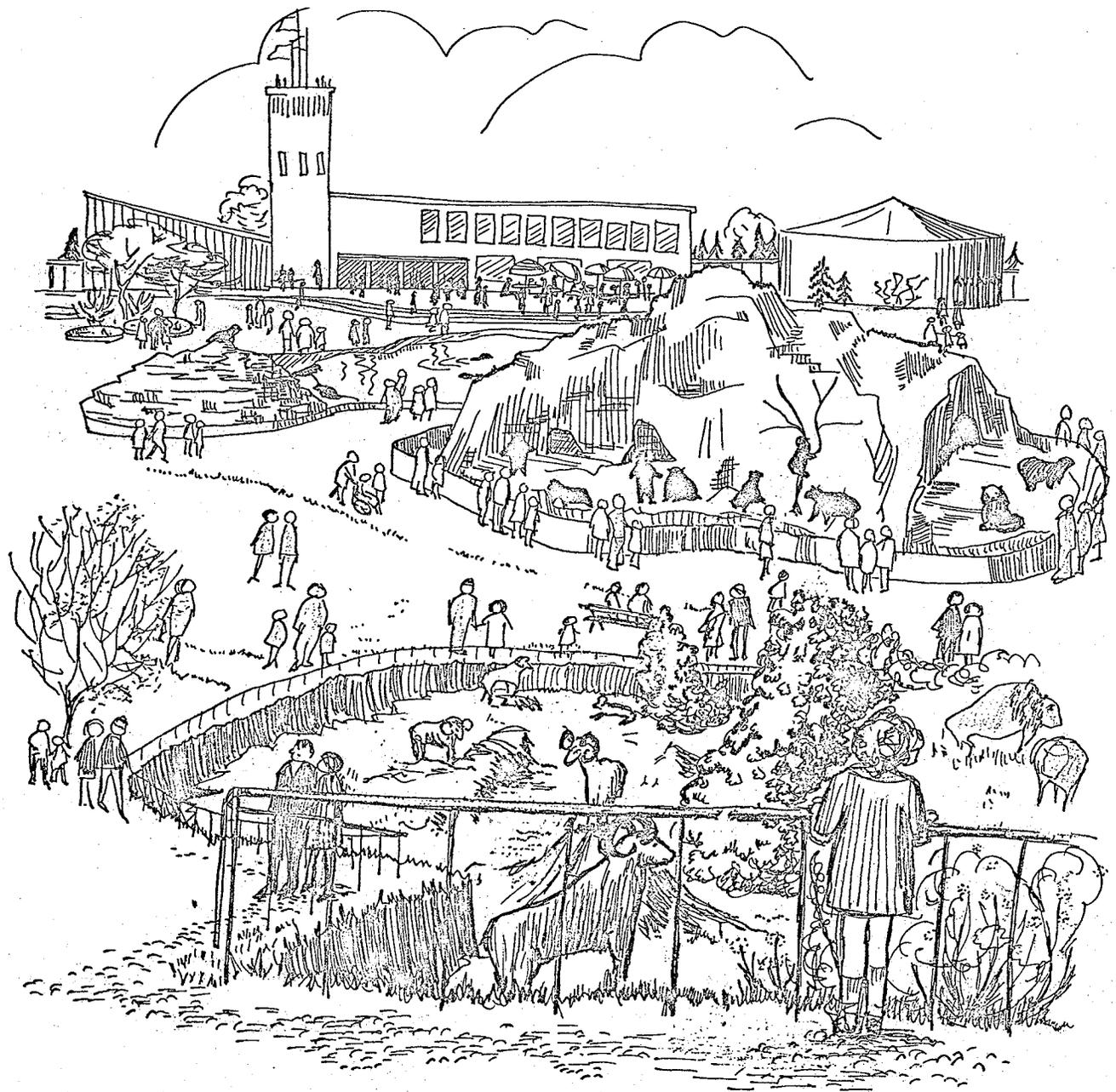
The more extensive paddocks are located away from the core. Here, a more deliberate path guides the visitor, who can follow this meandering route, enjoying its subtle transitions in breadth, knowing it will lead him past all the enclosures.

Orientation is also enhanced by designing landmarks such as the entrance tower, the bear enclosure or the "mountain".

Landscaping

The site has few natural scenic advantages, and consequently vistas and landmarks must be introduced artificially. Earthmoving is essential in creating a more varied topography, and a site of this size would warrant extensive landscaping. A major hill should be constructed between the maintenance area and the Children's Farm, and this will serve as a reference point for visitors, as well as an appropriate setting for mountain sheep and goat enclosures. This hill should be sufficiently large to accommodate a relatively steep path leading to a visitors' viewing point. The lower flanks of the hill give elevation to a section of the bison paddock and to a lawn which can later be converted into a muskox enclosure. This relief feature forms the backdrop to the main vista from the restaurant.

Extensive excavation will be required in the construction of numerous moats and pools, and this material can fortuitously be utilized in the creation of the "mountain" and several lesser hills. One major structure which will require excavation is the main aviary, which benefits from the incorporation of a sunken floor, permitting visitors entering the structure at ground level to have an elevated view of the interior.

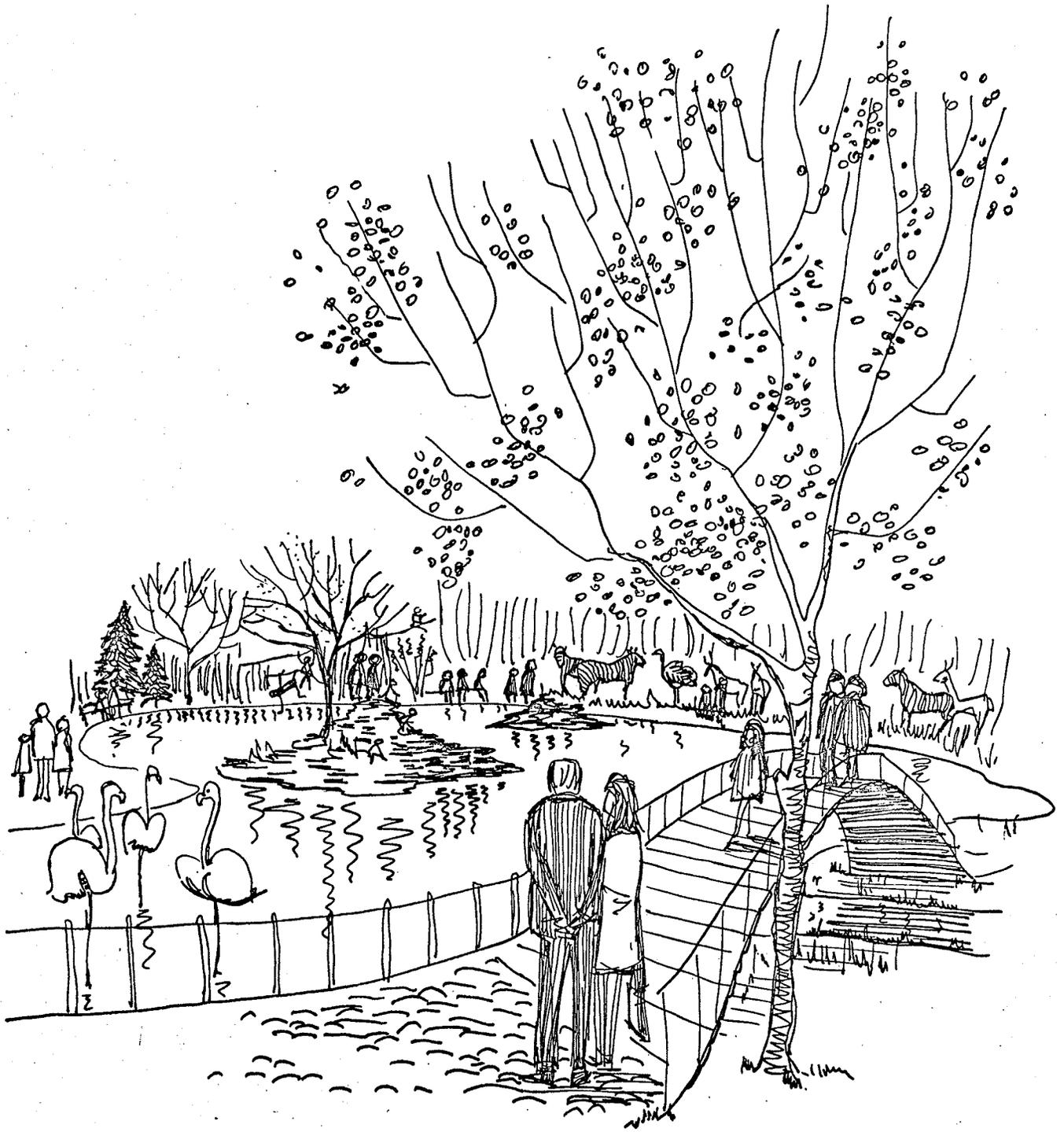


View from mountain exhibit.

Further excavation will be essential in construction of pools. A large seal and walrus exhibit is located close to the entrance. Backed by the jagged outline of the polar bear enclosure, this pool forms an impressive feature, and an appropriate introduction to the North American "continent". Since sea mammals are relatively uncommon in inland zoos this exhibit is a special attraction. It serves as a lively outdoor focus in winter¹ when the animals can be comfortably viewed from the restaurant.

Another series of pools is located nearby. Their scenic value is maximized by the creation of "natural" features like the waterfall which supplies the otter pond and the short which flows beneath a footbridge into the flamingo pool. A beaver dam in the neighbouring enclosure forms an attractive exhibit though water from the beaver pond is too debris laden to form part of the linked system. The large flamingo pool would also contain water-fowl, and two small, rocky "monkey islands". The latter are easily constructed, form popular features in many zoos, and in this case the inhabitants can be transferred seasonally from the islands to their winter quarters in the heated core nearby.

¹The problem of freezing over could be counteracted by using salt water or by forcing water into the pool under pressure. These measures would be assisted by the construction of a fairly deep pool which would in turn facilitate underwater viewing of the exhibits.



Footbridge by Flamingo Pool.

Apart from hills and waterbodies, an important scenic contribution may be made by skilful planting to add shape and depth to the layout. Where possible, planting should be solid around the perimeter, giving shelter from the wind, and forming a natural backdrop to each enclosure.

In places, trees and bushes can be used for dramatic effect. This might be recommended along the path which leads into "wolf wood", so as to heighten the forest atmosphere and give the visitor a sense of anticipation. A number of randomly planted pines or birches make an exciting setting for a wolf pack.

The Children's Farm is a somewhat specialised, if not incongruous feature and is given a sense of separateness by encircling heavy planting.

In most cases sturdy native species should be used to achieve bulk, though it might be advantageous to use some more ornamental shrubs in the many smaller occasional plantings. Bushes with a colourful bark, for example, would help enliven the layout in winter.

Later Additions

It is probable that much of Stage 1 will be completed before an attempt is made to expand with additions of more exotic species. It is also likely that as the zoo expands

in other areas it might be desirable to introduce a few more animals into the North American section. For this reason, several areas of lawn have been indicated in the preliminary stages. These can be readily converted into enclosures whenever such expansion should become necessary.

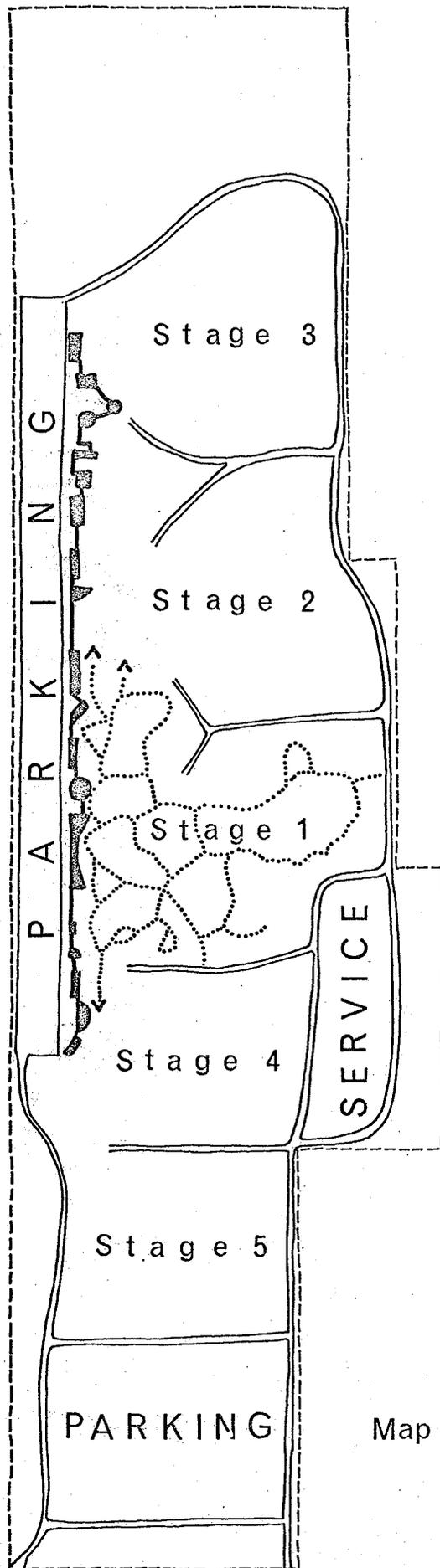
Until such growth can take place, however, the layout just described can be regarded as an entity, and should make an immediate contribution to the recreation facilities available in Saskatoon.

Chapter 10

Future Expansion

One of the main aims of this thesis has been to make a case for long-term zoo planning. In the previous chapters an attempt has been made to present a layout which is at once a distinct entity and also a component part of a planned growth sequence (Map 5). As a result, future development should occur with the minimum of disruption to earlier stages.

During Stage 1 the entire North American "continent" and part of the African "continent" are to be established. Subsequent expansion should take place towards the north so that the existing park facilities to the south of Stage 1 can be preserved as long as possible. In Stage 2, therefore, the African "continent" would be completed and part of a third unit



Map 5. Saskatoon Zoo
Proposed Expansion

begun.

The linear parking lot would be extended northwards, paralleled by the linked system of heated houses. Additional entrances would be opened to give direct access to the new "continents". The maintenance circuit would be extended to enclose the entire developed area, while the existing northern perimeter road would be truncated, thus allowing circulation between "continents" in the western part of the zoo. To the east, each "continental" pedestrian circuit would remain discrete.

In the final stages the zoo would expand towards the south, and eventually the entire park area would be developed as zoo property.

Few zoos have had the opportunity to initiate orderly growth, and many have suffered as a result. Saskatoon now has a chance to avoid past mistakes by adopting long-term zoo planning from the initial stages of its zoo's growth. In this way it can expect to achieve optimum conditions of animal comfort and visitor entertainment. It is to be hoped that, in developing a zoological park for Saskatoon, the Civic Authorities do not underestimate the recreational potential of a well-planned zoo. The development should not be seen as a marginal improvement to the present municipal parks structure. To do so would be to deny the opportunity of enjoying an outstanding amenity to the people of Saskatoon.

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Climate Statistics for Saskatoon

from; W.G. Kendrew and B.W. Currie, The climate of Central Canada
(Ottawa: Queen's Printer, 1955).

	TEMPERATURE (degrees Fahrenheit)			PRECIPITATION (inches)	
	Daily Mean	Monthly Mean		Mean	Mean
		Max.	Min.	Total	Snow
January	-1	37	-37	0.8	9
February	3	38	-34	0.5	5
March	17	48	-18	0.6	6
April	37	72	8	0.7	3
May	51	85	24	1.4	1
June	60	88	34	2.5	0
July	65	92	41	2.4	0
August	62	91	36	1.9	0
September	51	83	24	1.4	1
October	39	73	11	0.8	3
November	22	52	-12	0.5	5
December	7	40	-29	0.6	6

WINDS

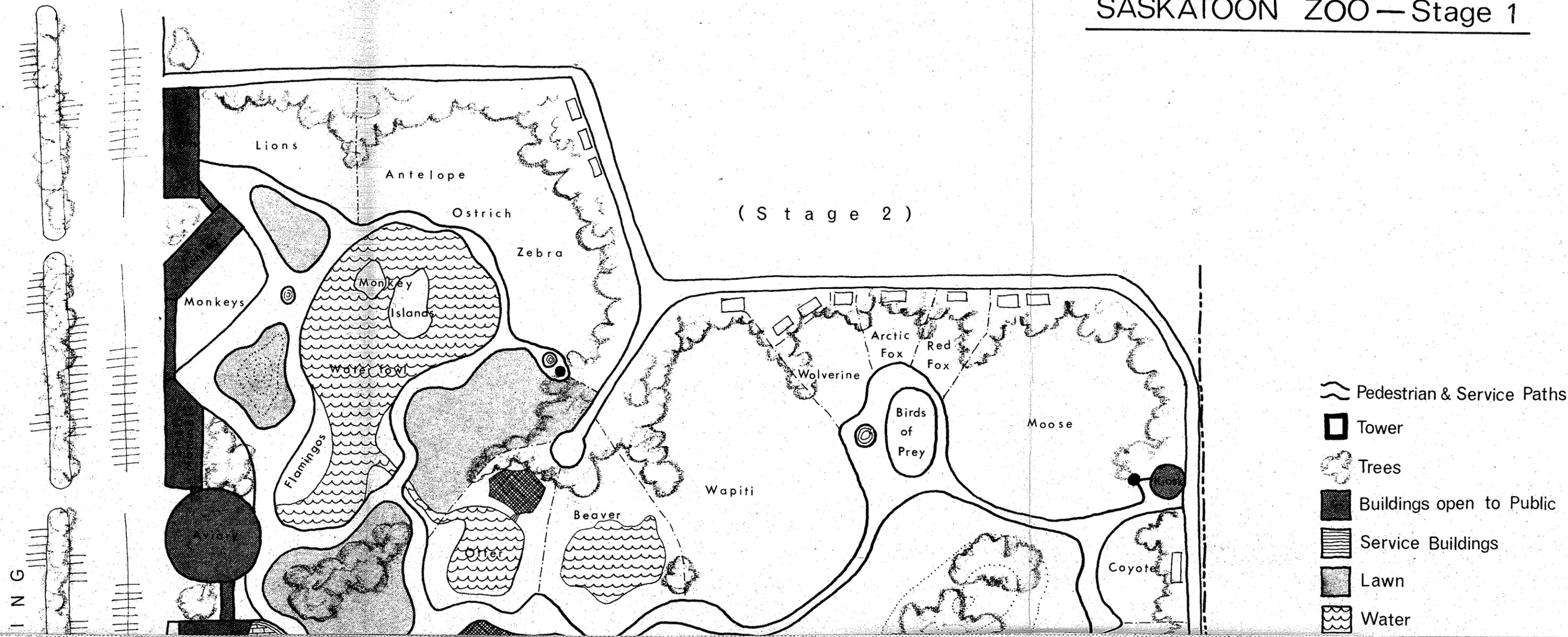
Mean Monthly Speed of Wind (m.p.h.) -- all directions

J	F	M	A	M	J	J	A	S	O	N	D	Year
10	9	11	13	13	11	10	11	10	12	11	10	10

FROST-FREE PERIOD

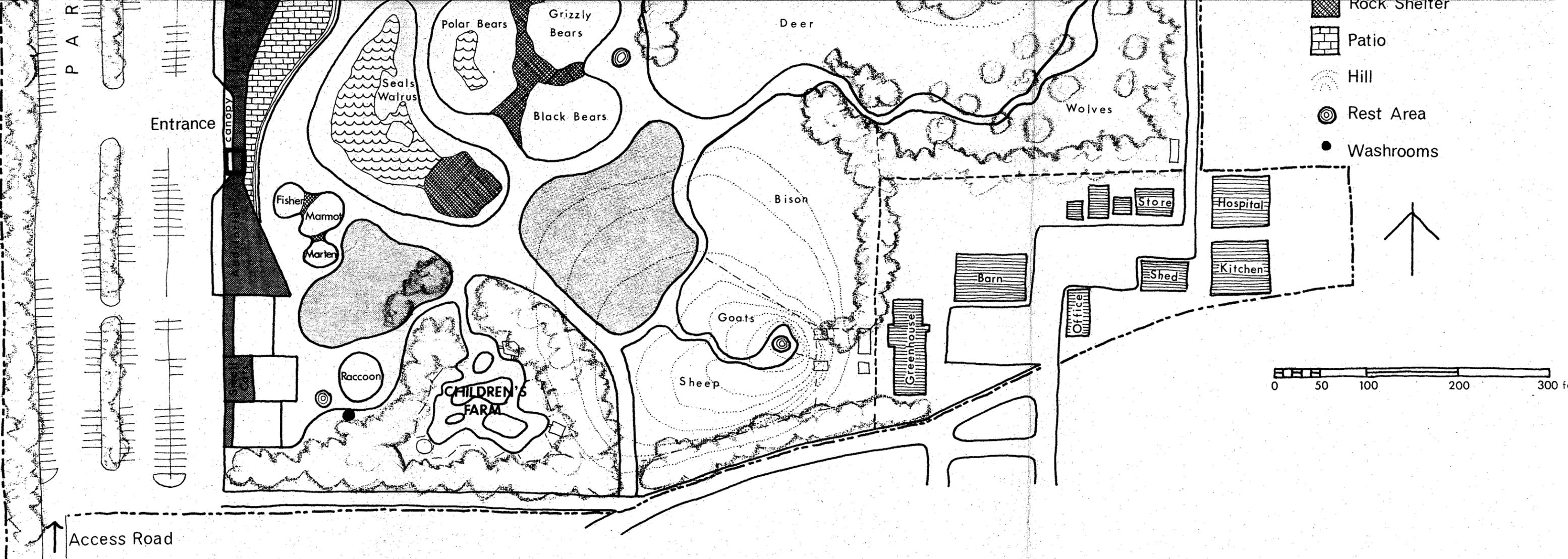
Mean	Last Spring Frost		Latest	First Autumn Frost			Mean Duration of frost-free period
	Earliest			Mean	Earliest	Latest	
26 May	26 April		29 June	9 Sept.	25 July	7 Oct.	106

SASKATOON ZOO — Stage 1

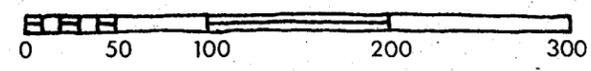


(Stage 2)

-  Pedestrian & Service Paths
-  Tower
-  Trees
-  Buildings open to Public
-  Service Buildings
-  Lawn
-  Water



↑ Access Road



-  Rock Shelter
-  Patio
-  Hill
-  Rest Area
-  Washrooms

P
A
R
K

Entrance

canopy

Polar Bears

Grizzly Bears

Deer

Seals
Walrus

Black Bears

Wolves

Fisher

Marmot

Marten

Bison

Store

Hospital

Raccoon

CHILDREN'S
FARM

Goats

Barn

Shed

Kitchen

Sheep

Greenhouse

Office