

ZOO DESIGNING AND LANDSCAPE ARCHITECTURE



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CENTRAL ZOO AUTHORITY

Ministry of Environment & Forests

Bikaner House, Annexe – IV, Shahjahan Road, New Delhi

Department of Landscape Architecture

SCHOOL OF PLANNING AND ARCHITECTURE

4, Block - B, Indraprastha Estate, New Delhi - 110 002

ZOO DESIGNING AND LANDSCAPE ARCHITECTURE



Orientation Workshop organized by
Department of Landscape Architecture
SCHOOL OF PLANNING AND ARCHITECTURE
4, Block - B, Indraprastha Estate, New Delhi

In collaboration with :



जहाँ है हरियाली !
वहाँ है खुशहाली !!

CENTRAL ZOO AUTHORITY
Ministry of Environment & Forests
Bikaner House, Annexe - IV, Shahjahan Road, New Delhi

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Prof. (Dr.) Surinder Suneja



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DAY - I



Importance of the Workshop on Zoo Designing and Landscape Planning

ZOO DESIGNING AND LANDSCAPE ARCHITECTURE PLANNING FOR ZOO ENGINEERS / ROS / ZOO DESIGNERS AND ENTREPRENEURS

PRESENTED BY –



MR. B.S. BONAL

- **MEMBER SECRETARY**

CENTRAL ZOO AUTHORITY (MINISTRY OF ENVIRONMENT AND FORESTS, GOVERNMENT OF INDIA)

THE CENTRAL ZOO AUTHORITY (A statutory body under the Ministry of Environment and Forests, Government of India, established in 1992)

- **MISSION:** To provide better upkeep and veterinary care to the wild animal housed in zoos in India to ensure their conservation through best practices of management and bringing education & awareness among the people.
- **VISION:** To complement and strengthen the national efforts in conservation of the biodiversity of the country, particularly the fauna through the ex-situ conservation linked with in-situ practices.
- **OBJECTIVE:** to enforce minimum standards and norms for upkeep and healthcare of animals in Indian zoos and to control mushrooming of unplanned and ill-conceived zoos



FUNCTIONS

- To evaluate and assess the functioning of the zoos
- To recognize or derecognize zoos
- To identify endangered species
- To coordinate the acquisition exchange
- Identify priorities, themes and approval of Master Plan
- Provide technical assistance to Zoos
- To release financial assistance to Zoos
- To ensure maintenance of studbooks
- To coordinate training of zoo personnel
- To coordinate research and education
- To perform such other functions
- To specify the minimum standards

EXPERT GROUP ON ZOO DESIGNING

Expert Group on zoo design- constituted coterminous with CZA. Functions :

- To scrutinize, suggest improvements, changes and make recommendations (to the Technical Committee) in the proposed master (layout) plan submitted by the various Zoos.
- To scrutinize, suggest improvements/ changes and approve/ disapprove the designs of animal enclosures submitted by various Zoos.
- To suggest standards and norms for designing of animal enclosures for various Zoos.

A zoo means an establishment, whether stationary or mobile, where captive animals are kept for exhibition for the public (and include rescue centers and circuses, but doesn't include an establishment of a licensed deal in captive animals.)

- The zoos – serve as a bio-diversity hub in urban landscape.
- The zoos – are green lungs in the urban landscape.
- No zoo can be established without prior approval of CZA and orders of Hon'ble Supreme Court.
- No zoo can run without being recognized by CZA.

RULES AND GUIDELINES

- Guidelines for utilization of volunteer in zoos
- Guidelines on prioritization as release of fund of CZA for Zoos
- Guidelines on conservation breeding programme
- Protocols on transportation programme



IMPROVEMENT OF ZOOS

- Strengthening of existing zoos as Centre of excellence -(NZP)
- Strengthening of existing zoos as model zoo – Each States / UTs
- Relocation of old zoos to new sites / de-novo at same site
- Strengthening of existing zoos as potential model zoos
- Other zoos

Zoo management is basically sole responsibility of Zoo operations not CZA. CZA is only a regulatory body.

ZOOS RELOCATED

New and increased area is selected and renamed again. Major planning is going on. Modern concept is used in these new sites.

Sl. No.	Name of the existing zoo	Area	Name of new site of zoo	Area
1.	Rustomjee Deer Park	2 ha	Himalayan Zoological Pak, Bulbul, Gangtok	205 ha
2.	Peshwe Park, Pune	3 ha	Rajiv Gandhi Zoological Park, Katraj, Pune	65 ha
3.	Sakkarbaug Zoo, Junagadh	6 ha	Sakkarbaug Zoo	198 ha
4.	Kamla Nehru Prani Udyan, Indore	11 ha	Kamla Nehru Prani Udyan, Indore	32 ha
5.	Sayaji Baug Zoo, Vadodara	15 ha	Ajwa Zoo at Ajwa	40 ha
6.	Kohima Zoo, Kohima	2 ha	Rangapahar Zoological Park	161 ha
7.	Mini Zoo Haddo (Port Blair)	3.75 ha	Biological Park, Chidiyatapu	40 ha
8.	Rajkot Zoo	5 ha	Rajkot Municipal Zoo	55.37 ha
9.	Mini Zoo, Bellary	2.4 ha	Atal Behari Vajpayee Zoological Park in the Bilikal Reserve Forest near Kamalpur of Hopset Taluk	64 ha
10	Jaipur Zoo, Jaipur	5.23 ha	Nahargarh Biological Park, Nahargarh	72.0 ha
11	Jodhpur Zoo,, Jodhpur	6.0 ha	Machai Biological Park, Udaipur	301.48 ha
12	Udaipur Zoo, Udaipur	5.2 ha	Sajjargarh Biological Park	35.69 ha
13	Kota Zoo, Kota	2.2 ha	Abheda Biological Park, Kota	126.0 ha
14	Bikaner Zoo, Bikaner		At Bichawaal.	10.0 ha

CONSERVATION BREEDING

- Flagship programme
- Identified 73 critically endangered wild animal species.
- Launched 19 species (CZA and states). Eg : Red Panda, Snow Leopard, Pangolin, LTM etc.
- Identified – coordinating zoos participating zoos
- Funding - 100% (Infrastructure , Biologist , Veterinary support)
- (Designs – Different than exhibit enclosure)



RULES, NORMS & GUIDELINES OF THE CENTRAL ZOO AUTHORITY ON ZOO DESIGNING & MASTER PLANNING

PRESENTED BY –



Dr. BRIJ KISHOR GUPTA

- EVALUATION & MONITORING OFFICER, *CENTRAL ZOO AUTHORITY*
- (*MINISTRY OF ENVIRONMENT & FORESTS*)
- MEMBER EXPERT GROUP ON ZOO DESIGNING OF CZA

UNSUNG HEROES IN ZOO DESIGN

- Mike Robinson
- Pushp Kumar
- Willie Laubascagne
- Karen Sauseman
- Laura Mumaw
- Murrey Newman
- Sherry Sheng
- Jon Coe
- Bernard Harrison

Zoos in India have achieved significant success in exhibit design due to role played by the central zoo authority since its establishment in February, 1992.

We need more such Unsung Heroes.....



ZOO ARCHITECTURE AND LANDSCAPE DESIGNING

NATIONAL ZOO POLICY, 1998

Research and Training

"The zoos shall encourage research on the biology, behaviour, nutrition and veterinary aspects of animals in their collection.

They shall also endeavor for creation of expertise on zoo architecture and landscape designing, cooperation of recognized institutions already working in relevant fields in this regard shall be taken".

Recognition of Zoo Rules, 2009

(Notified on 11th November, 2009)

- **Standard & Norms**
- **Rule 10, Sub Rule 4**
- **Animal housing, display of animals and animal enclosures**
 - To display the animals in nature immersing enclosures.
 - Designs and dimensions of every enclosure shall be determined having due regard to the biological behavior of the species and the number of animals to be housed & as per the standards specified by the Central Zoo Authority in this regard from time to time.
 - Safety and security of the animals, animal keepers and visitors.
 - Animal free movement, exercise and expression of natural behavior by the animals.
 - Adequate space shall also be made available to the animals in order to maintain safe distance from the dominant animals in the group or herd.
 - Enrichment of the environment of the enclosure.
 - Adequate screening shall be provided between adjacent enclosures to safeguard against the animals getting unduly excited or stressed due to visibility of animals housed in these enclosures.
 - Effective standoff barriers at every animal display enclosure to regulate the movement of visitors.

CZA'S GUIDELINES

Dimensions and size of animal enclosures

The land area to be given to any animal exhibit enclosure should be decided having due regard to the maximum number of animals that can be displayed.

The area of the enclosure should have adequate land space for facilitating the animals to have free movement and exercise.



The animal exhibit enclosures should not be given geometrical shapes, as the presence of corners is not congenial to smooth and unrestricted movement of animals. Enclosures with greater depth facilitate the animals to keep a safe distance from the visitors and are always preferable.

The dimensions and the area of any enclosure should be decided having due regard to various factors like topography and naturalistic features of site.

The area of the outdoor enclosures for herbivore safari and carnivore safari should not be less than 30 hectares and 20 hectares respectively.

Mini zoos being operated as Deer Parks and displaying mega species should not be of less than five hectares.

Display of animals in nature immersing enclosures

- Landscape around every animal exhibit/ enclosure should comprise of plantations of appropriate tree and shrub species.
- All the hard exteriors of the enclosure i.e. the enclosure barrier and the frontage of the feeding cells, feeding kraals should be effectively camouflaged through planting of bamboo, dwarf tree species and shrubs.
- Planting of appropriate trees and shrubs should be done around the animal viewing areas to break up the visitors into small viewing groups.
- Visitors should be made to move through the green landscape around the enclosure.
- Planting, appropriate trees species should be done in the enclosure to ensure that entire animal enclosure is not visible to the visitors from any of the viewing points. The animal should be seen to the visitors in near natural settings.

Enclosure Barrier

- Barrier of every enclosure should be of a design, dimension and material that can effectively contain the animals housed within the enclosure and safeguard against any animal escaping from the enclosure.
- Due care should also be taken to ensure that the shutters and doors fitted in the enclosure, kraal and feeding cell are of such material and design that these can not be broken/ opened by the animals housed in the enclosure.
- The barriers of all the enclosures, except the animal viewing area could comprise of natural cliffs (if any), wall, glass, power fence or chain-link fence, etc. of prescribed dimensions.



Feeding Cells and Kraals

- (i) Every animal enclosure would be provided with feeding cells and feeding kraals at the farthest point from the animal viewing area.
- (ii) The design and size of the feeding cells and feeding kraals should be such that these do not stand out and affect the natural environment of the enclosure.

Feeding cell may be constructed in depressed ground, whenever feasible, in other cases feeding cells and kraals should be screened through plantations of appropriate species.

All the feeding kraals should have pucca floors and should be covered from the top. Approach to the service door of the feeding kraal should not be through the main enclosure. These should be serviced through a service gallery which is so designed that adequate natural light and aeration is maintained in the gallery.

Environmental Enrichment of animal enclosures :

- Keep animals in compatible social groups.
- Provide adequate three dimensional space for exercising the normal movement behaviour patterns i.e. walking, flying and climbing.
- Provide suitable substrate to facilitate the animals to satisfy their digging, burrowing and exploratory instincts.
- Provide suitable trees, shrubs and bushes in the enclosures to provide the animals opportunities for climbing, swinging, feeding, clawing, playing, rubbing the antlers, etc.
- Burrows/dens could also be constructed to facilitate the animals to hibernate or to take shelter during extreme weather conditions.
- Plant grass and reeds to provide cover area for the animals.
- Fix mud pots, tree hollows, bamboo baskets to meet nesting and egg laying by birds.

Composite Animal Enclosure

- Composite animal enclosures by and large are quite attractive and are quite in vogue these days. The zoo operators, while designing any composite enclosure shall take due care to ensure that:
- Species housed in composite enclosure are compatible in nature.
- There is no competition between the species for utilization of space, food and natural resources. The species do not inter-breed.



Drive Through Enclosures (Safaries)

- Entry and exit to every drive through enclosure should be through a system of double gates with sufficient space between gates.
- The gates for drive through enclosure should be so designed and located that the person operating the gates can see and ensure that no animal is standing near the gate at that time when the gate is being opened for the vehicle getting into the enclosure.
- Arrangement should be in place to ensure that the two gates provided under the double gate entry and exit system do not open simultaneously. The 2nd gate should open when the first gate has been securely locked.
- Design of the double gates should be such that the same can be operated conveniently by one person only.
- The layout of roads in the drive through enclosure should be such that the visitors can be shown all the highlights of the enclosure without disturbing the animals in their withdrawal areas.

Walk Through Animal Enclosures

- The area open to access by visitors should be clearly delineated and demarcated.
- Visitors should be allowed to enter the walk through animal enclosure in controlled groups under proper supervision.
- All walk through exhibits should have double entry gates and double exit gates to safeguard against any animal from escaping out of the enclosure.

RECOGNITION OF ZOO RULES, 2009 (NOTIFIED ON 11TH NOVEMBER, 2009)

- Every zoo to prepare and get the master plan approved by the CZA.
- The deadline was fixed 10th November,
- Master Plan Period 20 years with provision of review at 10 year.
- detailed layout plan prepared on the basis of the theme adopted by the zoo, indicating the locations of green belts, lawns, gardens, animal display area, visitor facilities, support infrastructure for animal upkeep and healthcare, buildings for administrative and maintenance unit
- At least 30% of the area earmarked for the zoo shall be kept under green belt and natural vegetation and the area for animal housing shall not exceed 30% area of the zoo.



CZA's Format for Preparation of Master Plan

PART-I

Chapters

1. Introduction- (includes history, objectives, physical features like the topography of the area, geology, rock & soil, flora and fauna, climate, rainfall, season, approach, demography of the surrounding area, legal status of the land, sources of pollution, if any etc.)

For an existing zoo, the introduction section may also include, the present ground situation, layout, description of different facilities, difficulties faced in the management in the past and achievements

2. Appraisal of the present arrangement and constraints:

- Animal section, veterinary section, store and feed supply section, sanitation section, maintenance section, security section, water supply section, disposal of solid waste & liquid waste-sewerage, visitors amenities, lawns and gardens-landscape section and any other section peculiar to the zoo
- **Collection plan**
- **General Zoo administration section**
- **Research**
- **Conservation breeding**
- **Education and awareness**
- **Any other activity peculiar/ unique to the zoo**

CZA'S FORMAT FOR PREPARATION OF MASTER PLAN

Part-II

1. Future objective including mission statement/ theme

2. Future action plan

- Proposed animal collection plan including population size and justification of keeping the endangered species.
- Description of the layout plan of the zoo (Annexure –layout map on scale)

3. Personnel planning

This will provide the proposed cadre strength to manage different works considering the activities indicated in the plan including phasing of their deployment, outsourcing etc.



4. Disaster management

Plan to address problems faced during the natural calamities (Fire control, flood, cyclone situations, law and order break down, feed supply etc.)

5. Contingency plan

- Animal rescued from wild.
- Escape of animals from enclosures.
- Monkey and dog menace.
- Arrangement of food in case of strike (non supply by contractor)
- Snake bite.
- Visitors getting injured/ visitors falling inside enclosure.
- Fighting among animals
- Epidemics
- Breakdown of power supply

6. Capacity building & E-governance

7. Broad budget analysis for implementing the plan

Plan to upgrade skills of zoo staff, interaction with other zoos - regional cooperation.

Construction and development

Day to day maintenance

Part – III

MANAGEMENT PLAN

- The management plan shall be a document which will detail out the activities to be taken up in the line indicated in the Master Plan of the zoo for a particular time frame (1year to 5years), prioritising of the works to be taken up in phases and financial year wise and provide realistic estimates of the proposed works indicating the sources of funding.
- This should also contain revenue to be collected and funding expected to be received from the government and other sources.
- Strategy to be adopted for achieving the goals defined in the Master Plan (Part-II).
- In other words this will be a working document that will guide the managers of the zoo for the management plan period and facilitate the budgeting and focused development. This will help any new incumbent to carryout development without dislocation



ANNEXURE TO THE MASTER PLAN

- Existing zoos requiring modernization:-
- Preface/Foreword from CWLW/Zoo Operator/Director
- Copy of Certificate containing signatures
- the responsibility of mobilizing the financial resources for implementation of the Master Plan will be the sole responsibility of the State Government or respective Zoo Operator, and
- The State Government or respective Zoo Operator should quantify the resources available for the implementation of Master Plan.
- Layout plan depicting the present setup (animal enclosures, administrative building, visitor amenities, roads (service & visitors pathway)etc). Older maps, if available to indicate stages of development, map showing water circulation, electricity supply, Service lines like sewage/ drainage and electricity supply should be shown in layout plan).
- Existing animal collection plan/ inventory
- Free living species occurring in the zoo campus
- Flora and fauna
- Present staffing pattern and position
- List of buildings other than animal enclosures
- Notifications- creation of zoo society, acquisition of land etc., constitution of committees
- For new zoos- Site map, legal status of the land, proposed collection plan for animals (list of species)
- Notification etc.
- Proposed staffing pattern

ADDITIONAL GUIDELINES

Creation of staff quarters within the zoo campus

- No residential colonies for shall be constructed within the zoo premises following category of staff should be separated by a boundary wall from the animal exhibit areas.
- Where such colonies already exist, the same shall be separated from the zoo premises by a boundary wall with a minimum height of 2 meters from the ground level. The entry to the residential colony shall not be through the zoo premises.



Arrangement to provide lighting within the animal enclosures and other areas

- The zoo should have a provision for emergency lighting inside the animal enclosures.
- The lighting in other areas may be provided, if required, at a lesser intensity to avoid disturbance to animals on account of glare.
- The alternate lighting like solar lights may be given preference

Creation of Night Safari/ Safari

- The Central Zoo Authority will not accord approval for creation of night safaris and safaris diverting the forest land. The existing zoos may establish night safaris/ safaris without causing any adverse impact on the animal facilities in the zoo.
- The Central Zoo Authority should not provide any financial assistance for establishing of night safaris/ safari in any zoo.

FACILITIES FOR VISITORS

Children Park

- The zoos may have a separate area earmarked as Children Park with focus on wildlife conservation.

Boating

- No zoo should allow boating activities inside the water bodies used as wintering ground by migratory birds. The existing boating facilities could however be continued in a very regulated manner, ensuring that it does not disturb the zoo animals in the nearby enclosures.
- No new water body should be created in any zoo for creating boating facilities.

Train/ tram/ toy train/ battery operated vehicle

- Zoos larger than 50 hectares may have train/ trolley facilities if such facilities enable visitors to get a better view of the animals housed in various enclosures, without causing the disturbance and pollution. No Train/ trolley facilities should be permitted for recreation.

Entry of private vehicle

- Zoo should not allow entry of private vehicles, if public facilities like battery operated trolley/ golf carts/ train exist there. If the area of the zoo is more than 75 hectares and facilities as mentioned above are not available, private vehicles may be permitted on specified routes on payment of such fees, and subject to such regulations as deemed appropriate by the management of the zoo.

Interpretation centre/ orientation centre

- Zoos should be encouraged to create or establish interpretation centres preferably adjacent to the entrance, as such facilities are useful in conveying the conservation message to visitors. The Central Zoo Authority may provide financial assistance for creation of the interpretation centre within the zoos on case to case basis.



Food courts/ kiosk/ restaurant

- The food courts/ kiosk/ restaurant should be restricted at the entrance of the zoo. However, the some kiosks (1-3 numbers) may be located suitably inside the zoo. It was also pointed out that such food courts/ kiosk/ restaurant should not cater/ sell any take away food, package or disposable water bottles. Sale of alcoholic beverage should be banned.

Parties/ functions/ marriages/ melas

- The zoos should not allow their premises for holding party/ function/ marriage/ mela. However, the zoo premises may be used for holding meetings/ conferences/ workshops related to the wildlife conservation. The zoos must ensure that such activities are carried out keeping in view of the welfare of the animals.

Rest houses/ hotels

The creation of rest houses/ hotels within the zoo premises should not be permitted. **Limiting the numbers of the visitors at any point of time in the zoos**

- The zoo should make an effort to control the number of visitors at any point in time, if they are beyond the carrying capacity of the zoo (calculated adopting an appropriate method). The following methods were suggested to control the number of visitors:-
- By increasing the entrance fee for the visitors on particular days.
- Increasing the working hours of the zoo.
- It is also recommended that the zoo should assess its carrying capacity and try to limit the number of visitors accordingly.

Souvenir shops

- The zoos may provide souvenir shops at an appropriate place within the zoo or at the entrance.

Telephone booths

- The telephones are considered as an essential service today, the same should be allowed at appropriate places.

Museum

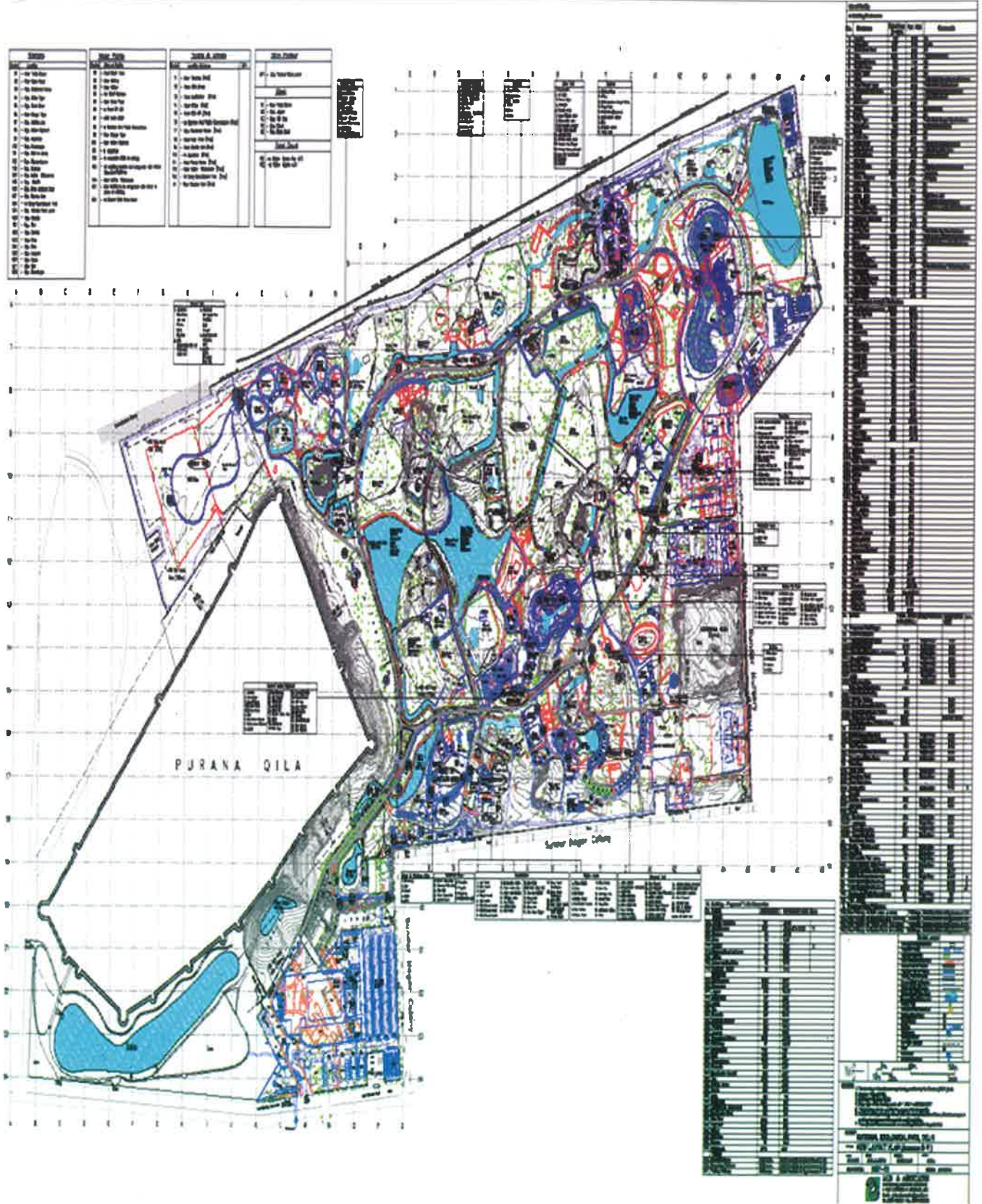
- The creation of new museum in the zoo should be discouraged and the existing zoos having museums should be asked to separate these from the animal exhibit area.

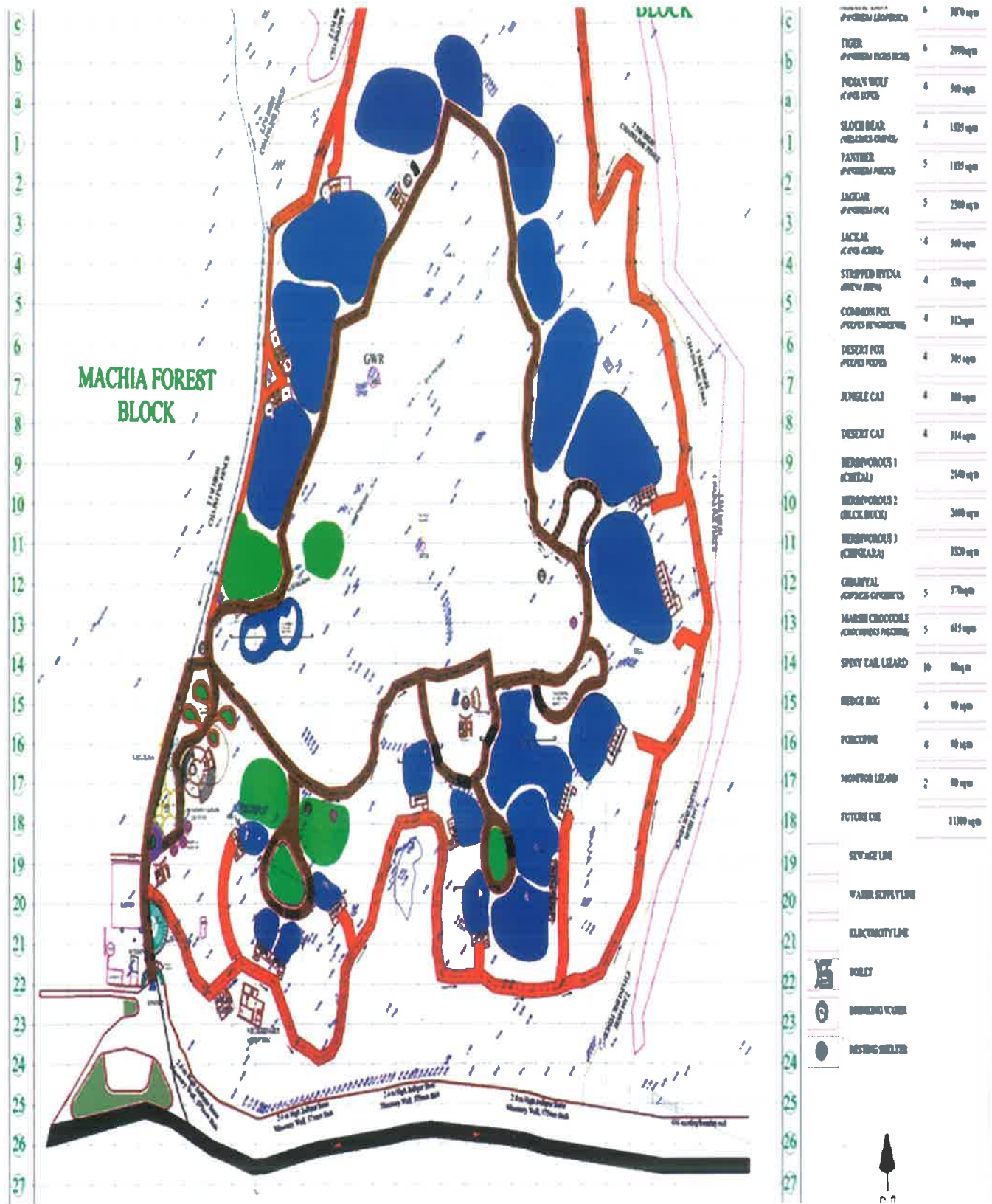
Botanical gardens

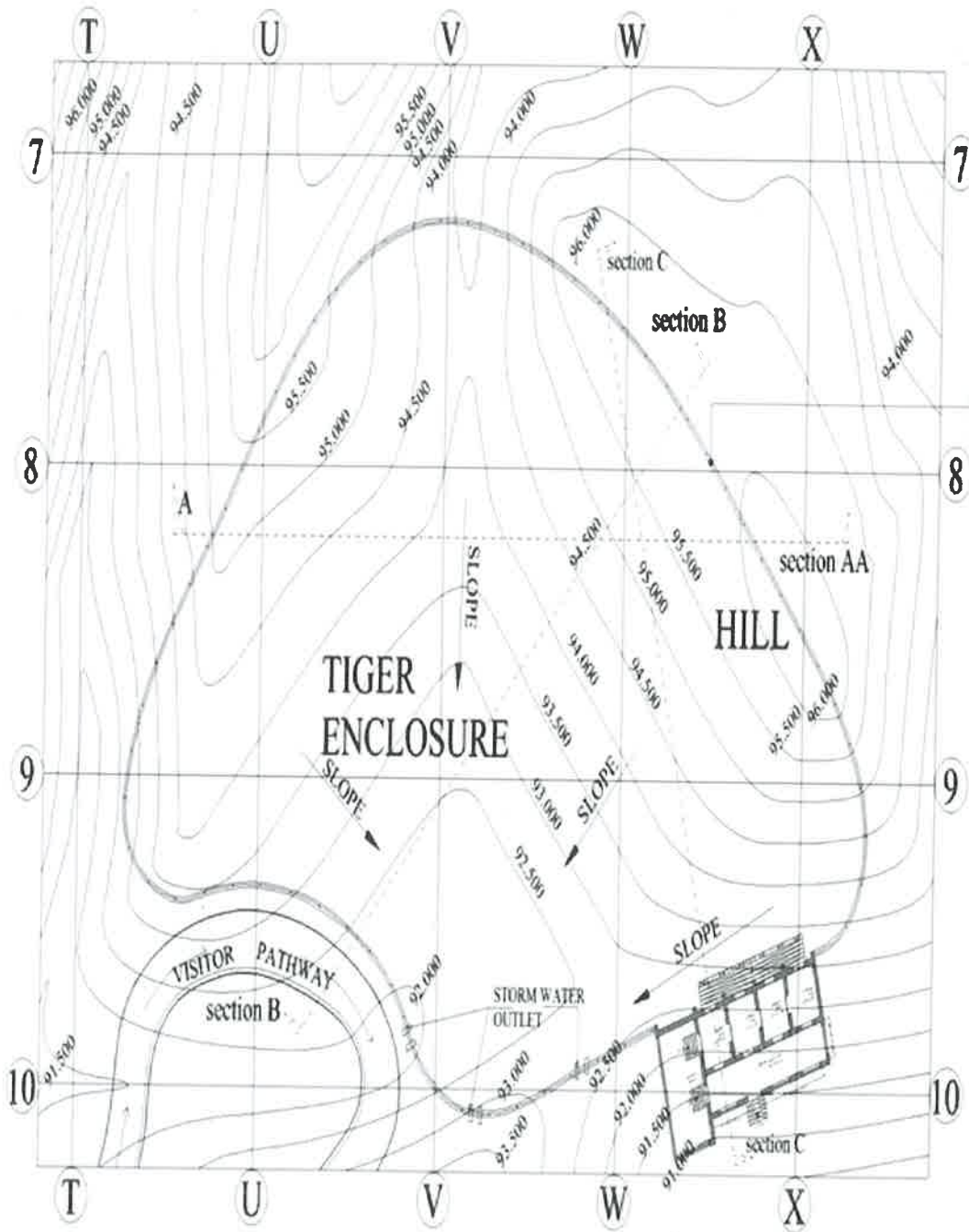
- The Botanical gardens in zoos should be encouraged which may also include butterfly park, arboretum, green houses, nurseries, orchidarium and green shops.

Colour Code for Master (layout) Plan

- Existing animal enclosures (black colour).
- Enclosures to be modified (green colour).
- Enclosures that need to be redone after demolishing the old structure (red colour).
- Proposed new enclosures (blue colour).







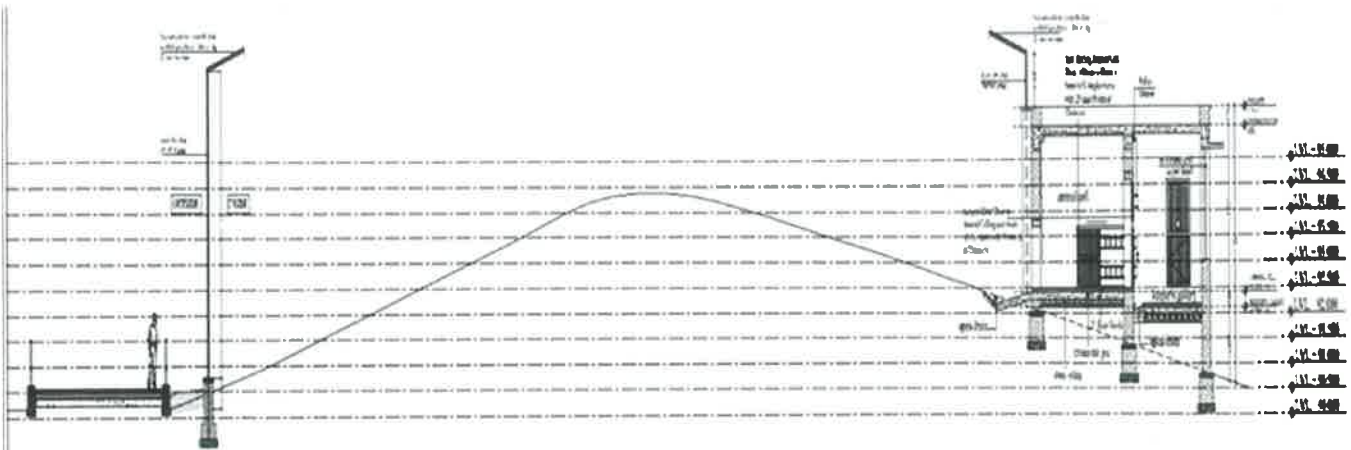
Chain link Fence 30mm x 30mm @ 5m high
 on 75mm dia. 600mm high Jodhpur Stone
 Masonry wall with 60° inclined 1.5m overhang
 with barbed wire

- Chain link Fence 30mm x 30mm X 5mm X 4g (5 M High) Erod to 75 mm x 75 mm x 6mm angle iron posts (40 per CZA)

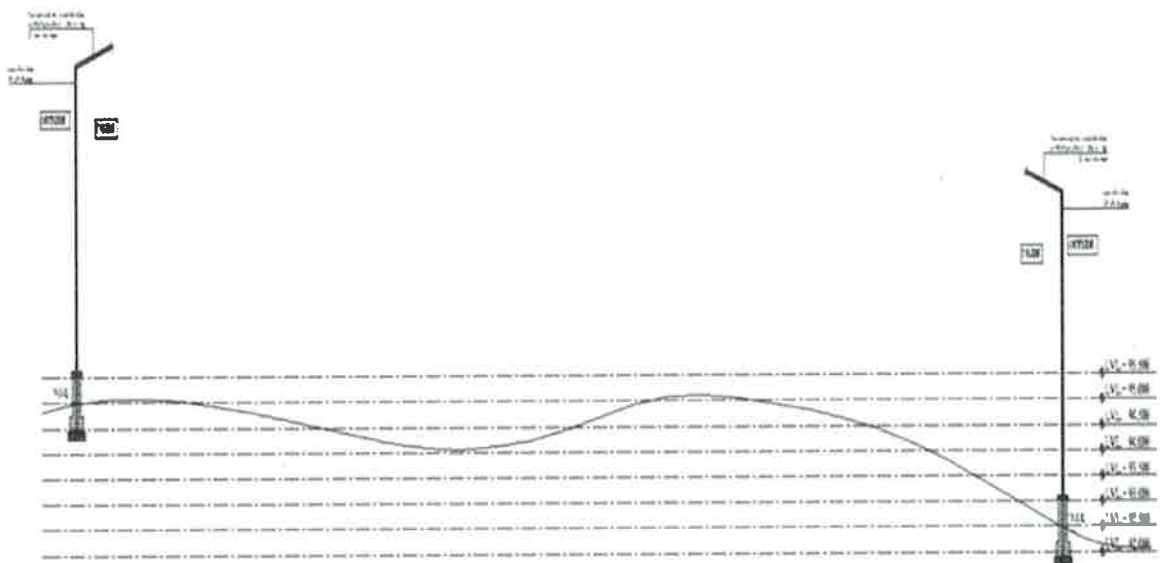
PLAN GRID SIZE
20M X 20 M

TIGER ENCLOSURE

<p>PROPOSED SATELLITE MACHHA BIOLOGICAL PARK, JOORPUR</p> <p>RSRDC</p> <p>PL. NO. 10/10/10/10/10</p>		<p>NO. 10/10/10/10/10</p> <p>10/10/10/10/10</p> <p>10/10/10/10/10</p> <p>10/10/10/10/10</p> <p>10/10/10/10/10</p>	<p>PROPOSED PLAN</p> <p>10/10/10/10/10</p>	<p>GRID ENCLASURE</p> <p>10/10/10/10/10</p>	<p>10/10/10/10/10</p> <p>10/10/10/10/10</p> <p>10/10/10/10/10</p> <p>10/10/10/10/10</p>
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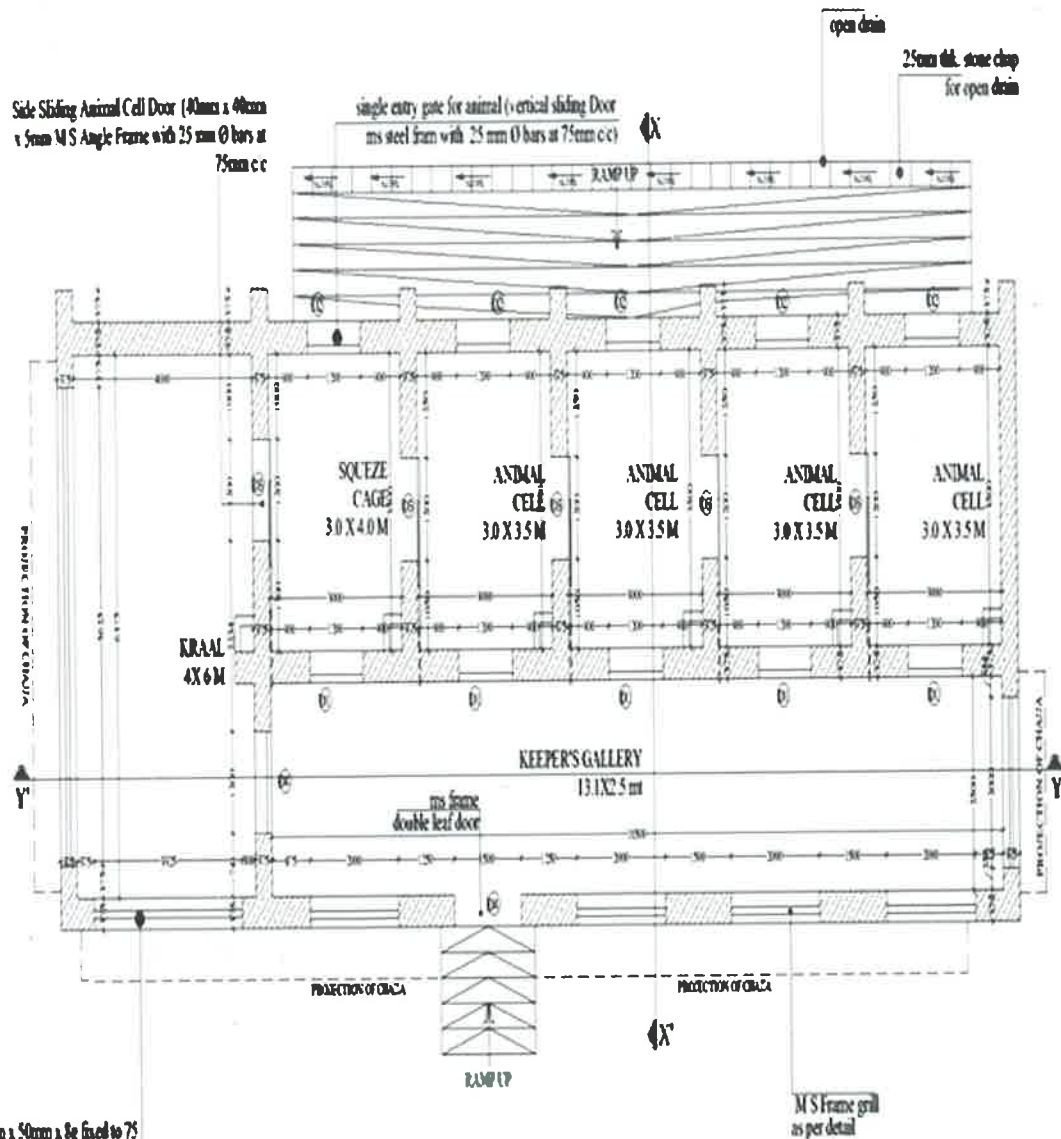
SECTION A-A



SECTION B-B

PANTHER ENCLOSURE

PROJECT PROPOSED SATELLITE MACHHA BIOLOGICAL PARK, JOODHPUR	SITE RSIDC		NO. DATE REVISION BY/CR	PROPOSAL SECTION PLAN 2/2	PANTHER ENCLOSURE VIEW 1/1	DATE: 21/03/21 SCALE: 1/50 DRAWING NO.: 2021/03/01	1.000 1/1/21 Eye to life and the world under THE YODHS' and the world under the eye of the world	Architecture Concept Landscape Interior	
	THE YODHS' AMPLR		1 23.03.21 Initial design concept 2 23.03.21 After discussion with 20/03/21 3 23.03.21 After 20/03/21 discussion 4 23.03.21 New design and discussion of content 5 23.03.21 Final design and 20/03/21 6 23.03.21 Final design and discussion of content						



chain link fence 50mm x 50mm x 8g fixed to 75mm x 75mm x 8mm angle iron posts at 2m c/c in c/c on 375mm th. & 750mm high jodhpur stone masonry wall from ground l.l. with 60° inclined inward steel plate of 1m width on top as per detail

PANTHER ENCLOSURE

Plan Holding Area/Night Shelter

PROJECT PROPOSED SATELLITE MACHHA BIOLOGICAL PARK, JODHPUR	DATE: _____	NO. DATE REVISION BY/CA	DRAWING SHEET NO. _____	SHEET NO. _____	PROJECT NO. _____	DATE: 25/08/2021	SCALE: 1/1	DRAWING NO. _____
	DRAWN BY: R.SUDH							
PROJECT NO. _____	CHECKED BY: _____	1. 25/08/2021 Initial design	PANTHER ENCLOSURE	SHEET NO. _____	PROJECT NO. _____	DATE: 25/08/2021	SCALE: 1/1	DRAWING NO. _____
PROJECT NO. _____	PROJECT NO. _____	2. 25/08/2021 Final design	SHEET NO. _____	SHEET NO. _____	PROJECT NO. _____	DATE: 25/08/2021	SCALE: 1/1	DRAWING NO. _____



GUIDELINES FOR SUBMISSION OF DESIGN OF THE ANIMALS ENCLOSURE TO THE CENTRAL ZOO AUTHORITY:

- The design should be labeled by giving titles like plan, elevation, cross-section at the top. It should also include dimensions of entry doors/ sliding doors and windows.
- The design of the animal enclosure either proposed as a new or modification/ extension/ renovation should contain a copy of layout plan showing the location.
- The animal house should be preferably located outside the paddock area instead of protruding inside the animal enclosure.

GUIDELINES FOR SUBMISSION OF DESIGN OF THE ANIMALS ENCLOSURE TO THE CENTRAL ZOO AUTHORITY

- Whenever, the Central Zoo Authority's funds required for such works, the estimates should be prepared and submitted, once the design is approved by the Central Zoo Authority.
- Three sets of the design should be submitted with signature of the zoo director for its scrutiny.



ZOO ENVIRONMENTS FOR PEOPLE PLANTS AND ANIMALS - I

PRESENTED BY -



Mr. JON COE

- MASTER OF LANDSCAPE ARCHITECTURE
- FOUNDING PRINCIPAL, 2004 -JON COE DESIGN, PTY. LTD., HEALESVILLE, VICTORIA, AUSTRALIA
- Zoo Environments for People Plants and Animals
- Integrating Zoo Design and Management
- 20th Century Zoo Design Cannot Function Without 20th Century Zoo Management
- Site capacity should be kept in mind

Part Two Conservation (Genetic Competence Behavioural Competence)

Competence

- Natural
- Learned
- Competent Independence

Genetic

- Long-term breeding programs
- Insurance populations
- Rescue and re-introduction
- Animal health and well-being



Behavioural

- Environmental enrichment
- Behavioural conditioning
- Animal choices and self-sufficiency
- Animal mental health

The Competent Animal

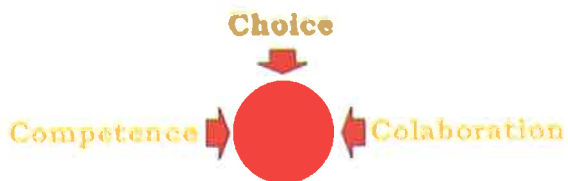
The Next Frontier - Giving Animals Choices

"The organism with the greatest number of choices has the greatest freedom."

Jon Coe

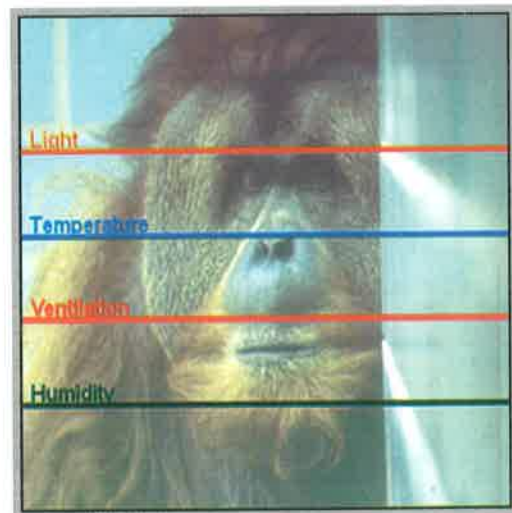
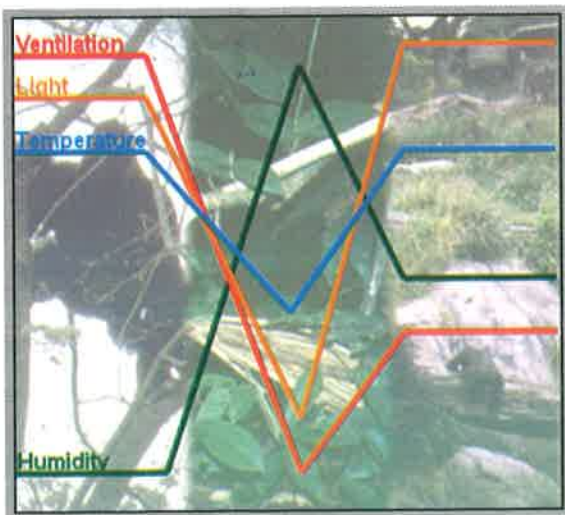
Choice + Control = Freedom

The 3-C's - Competence + Choice + Collaboration



Environmental Enrichment

Interactive Enrichment Features



Rainforest Environmental Gradients (hypothetical Conventional Primate Holding Micro-Climature Gradients (hypothetical))

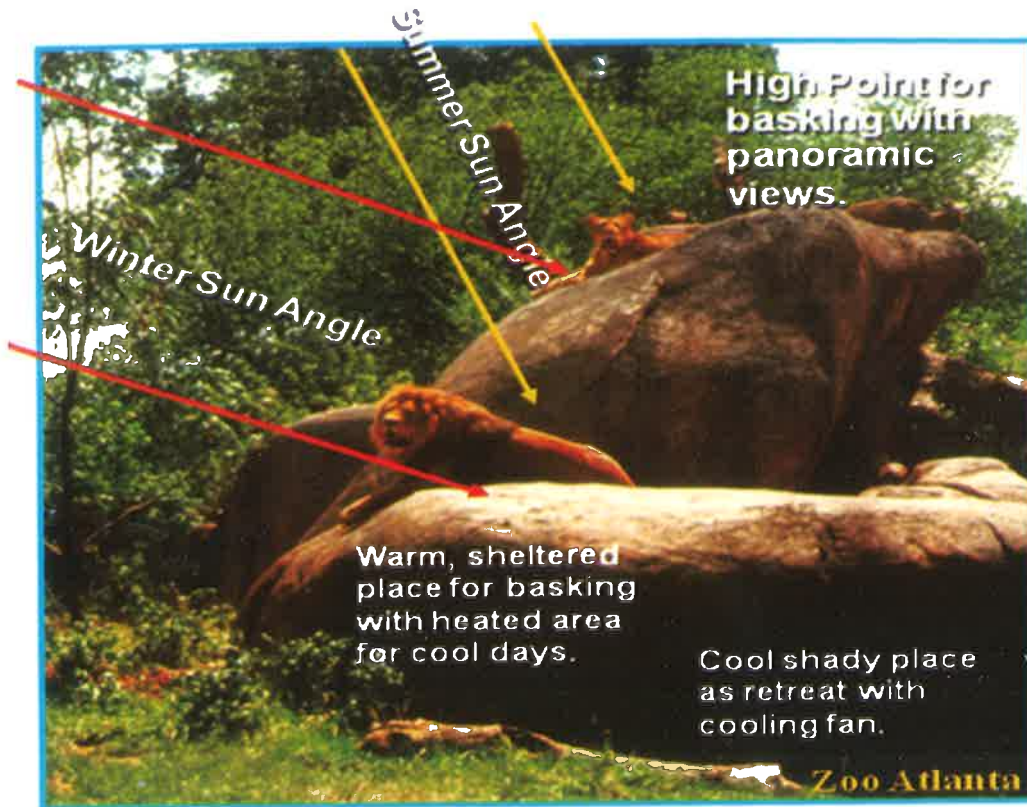
Environmental Choice

- Lighting
- Heating and cooling
- Ventilation
- Create gradients and choices

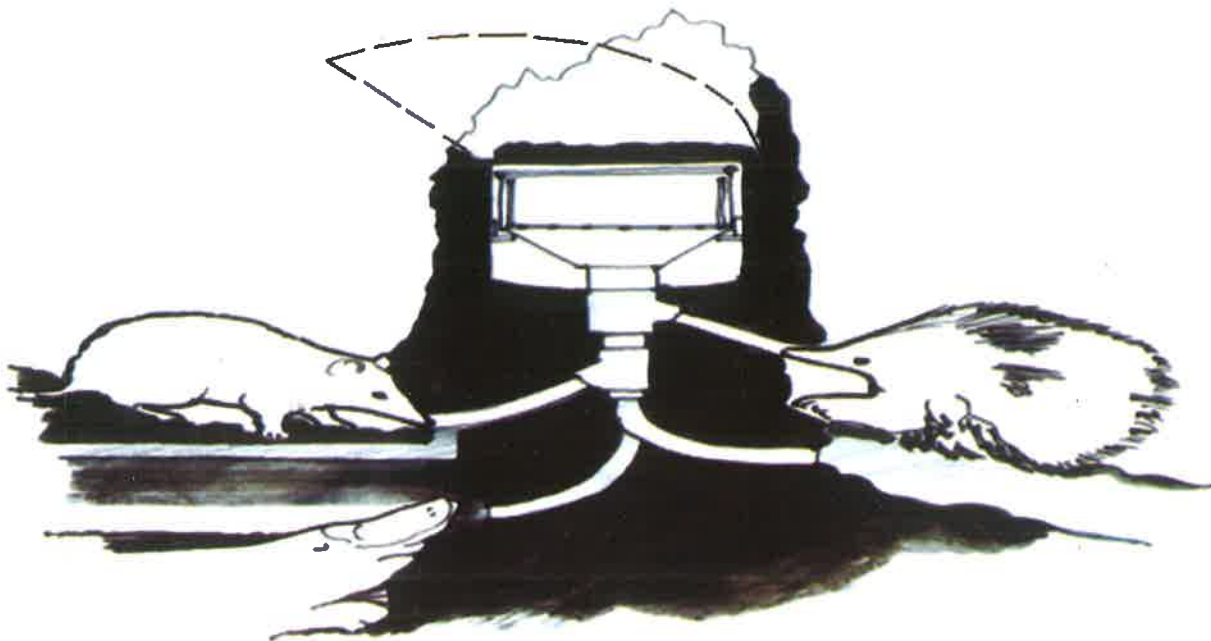


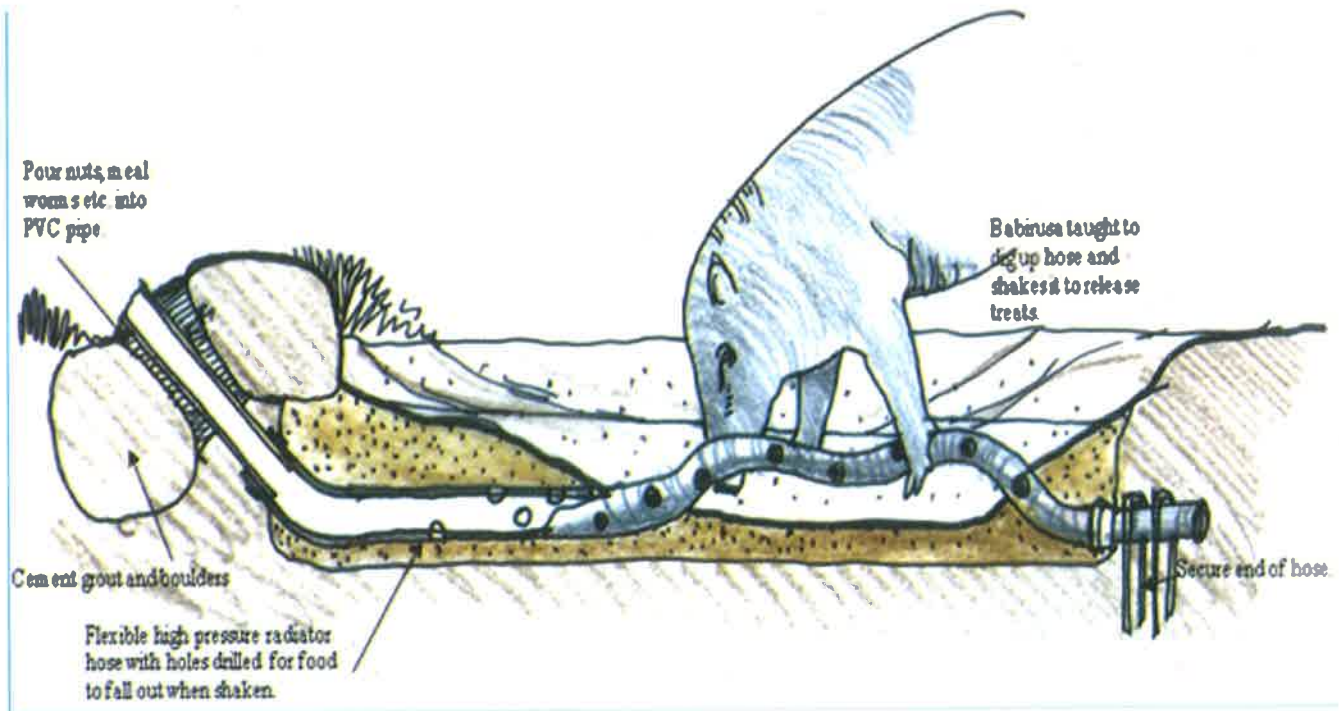
Built in Features of Enduring Interest to Animals

Artificial Termite Mound

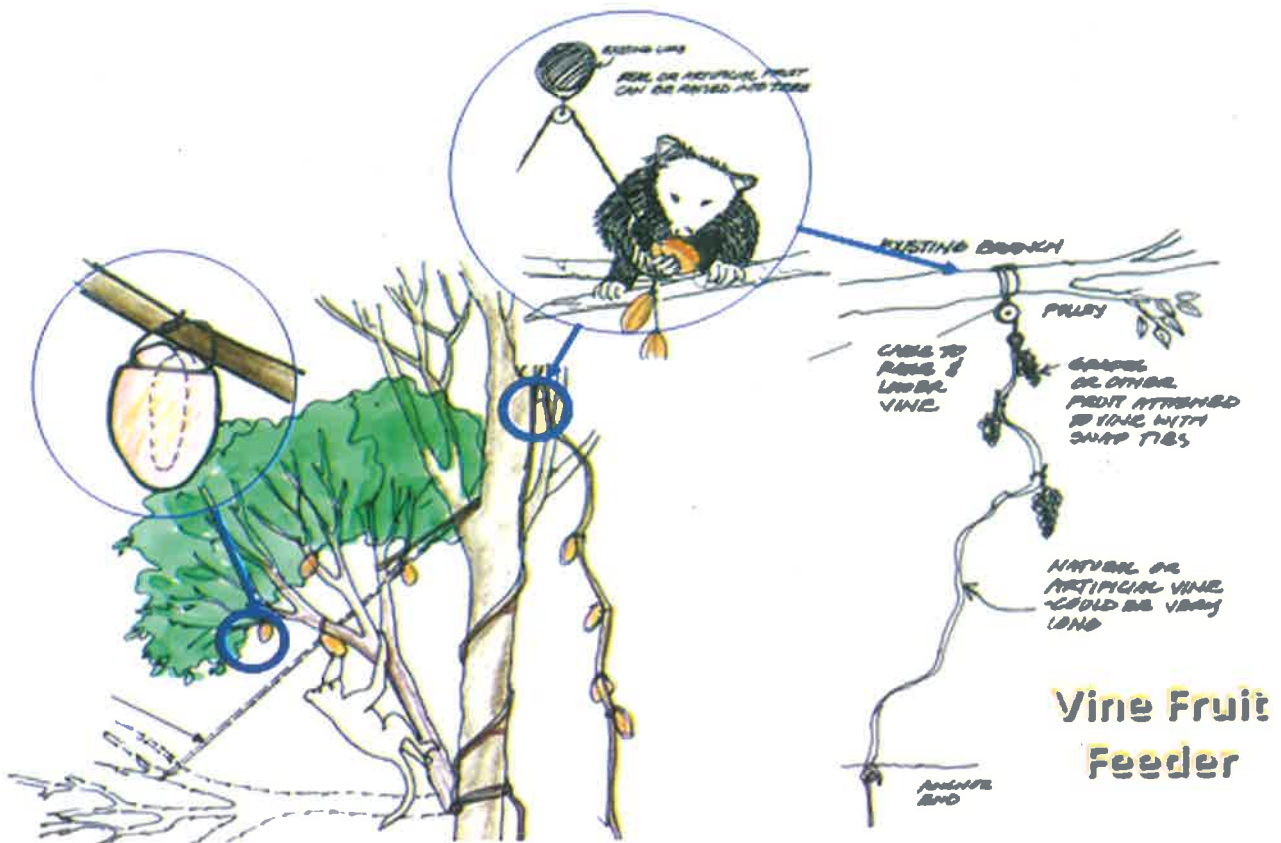


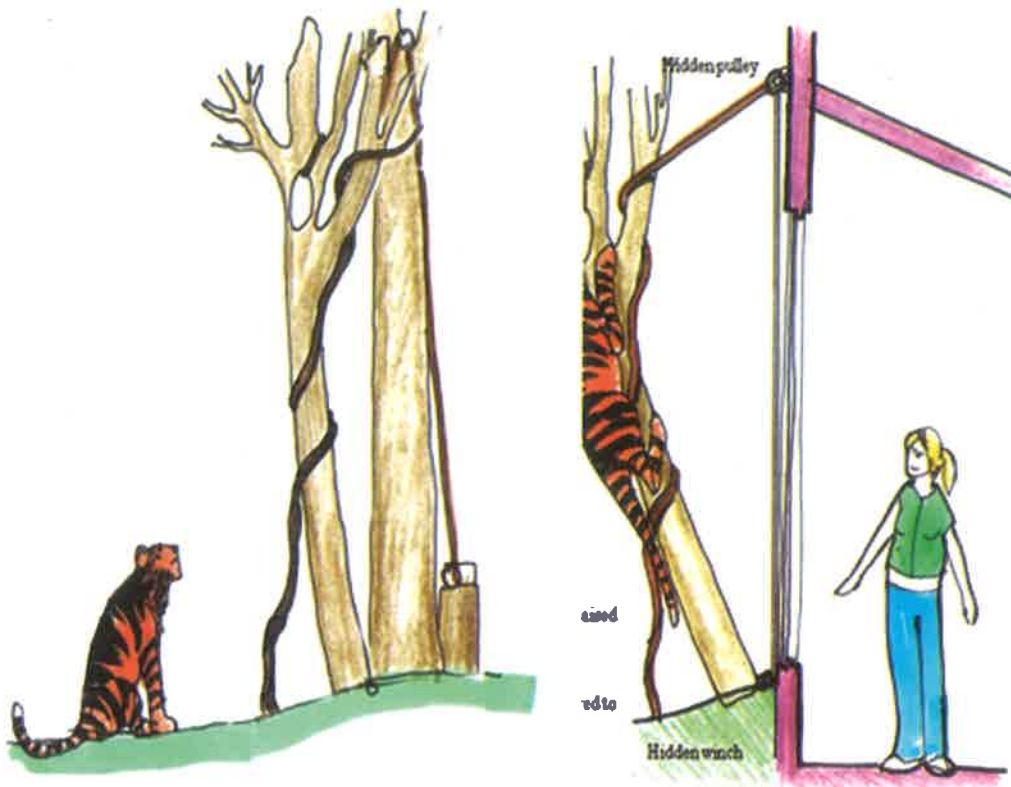
Moving Enrichment Features



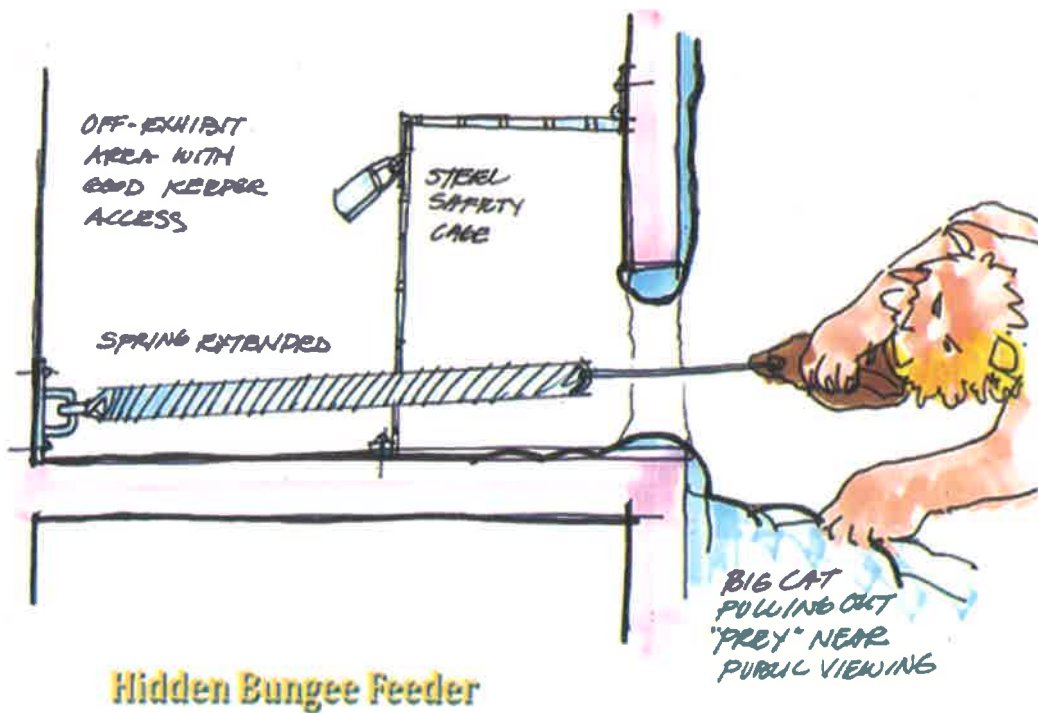


Sway Branch Concept

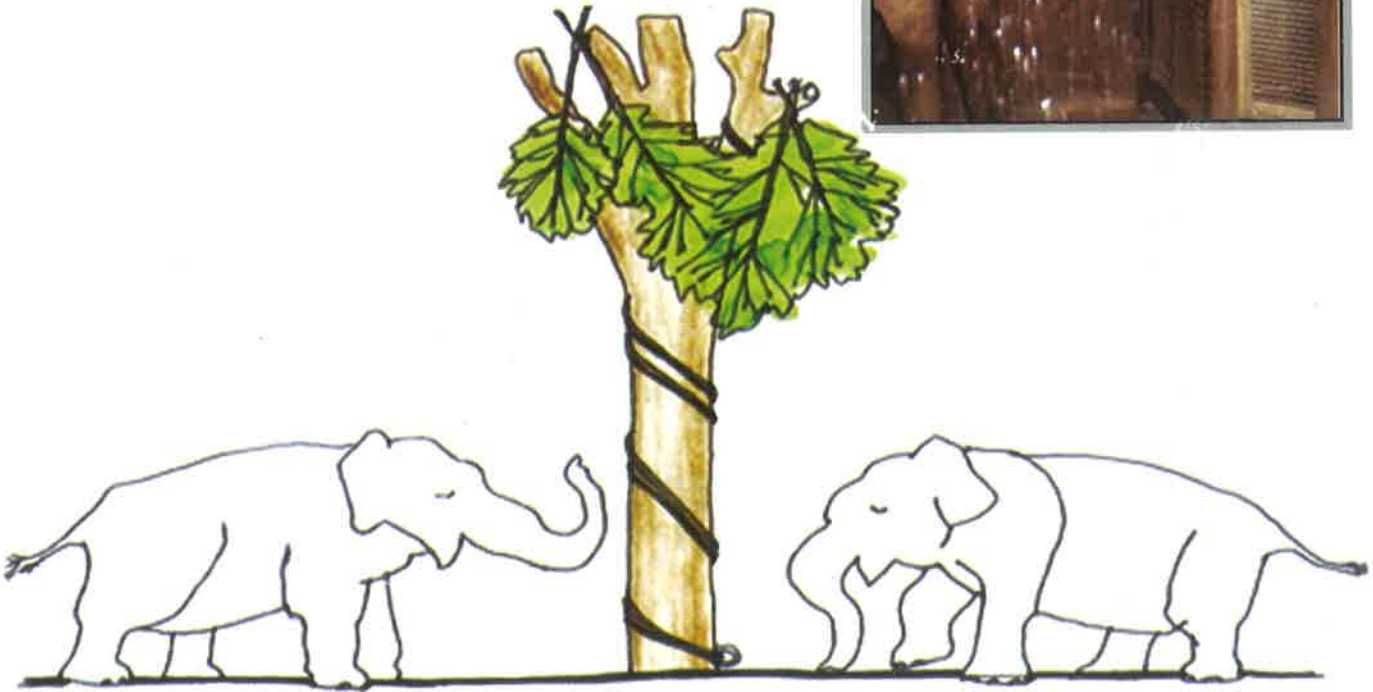
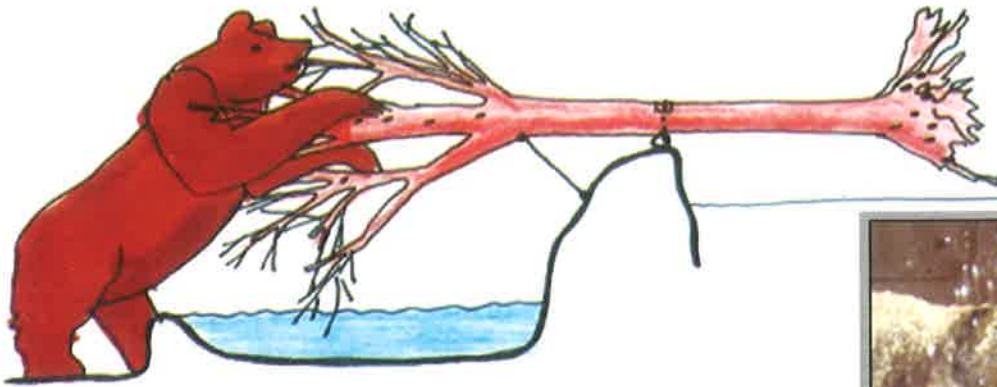




Sway Feeding Pole Attached to Building



Hidden Bungee Feeder



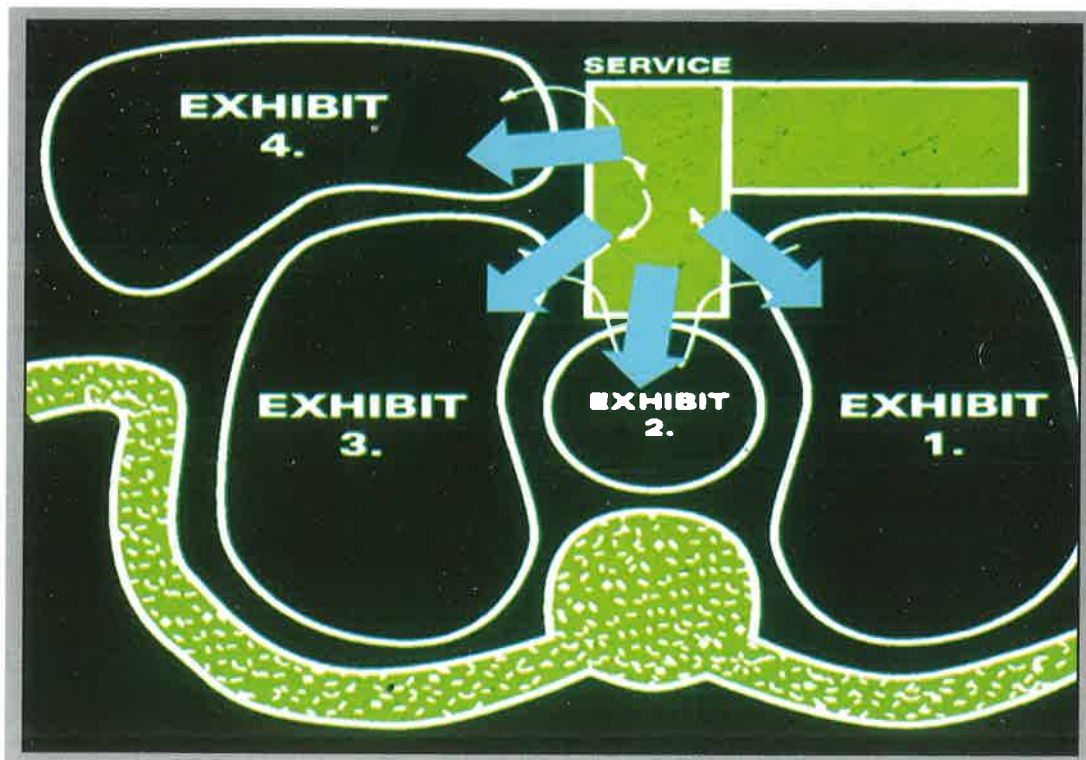
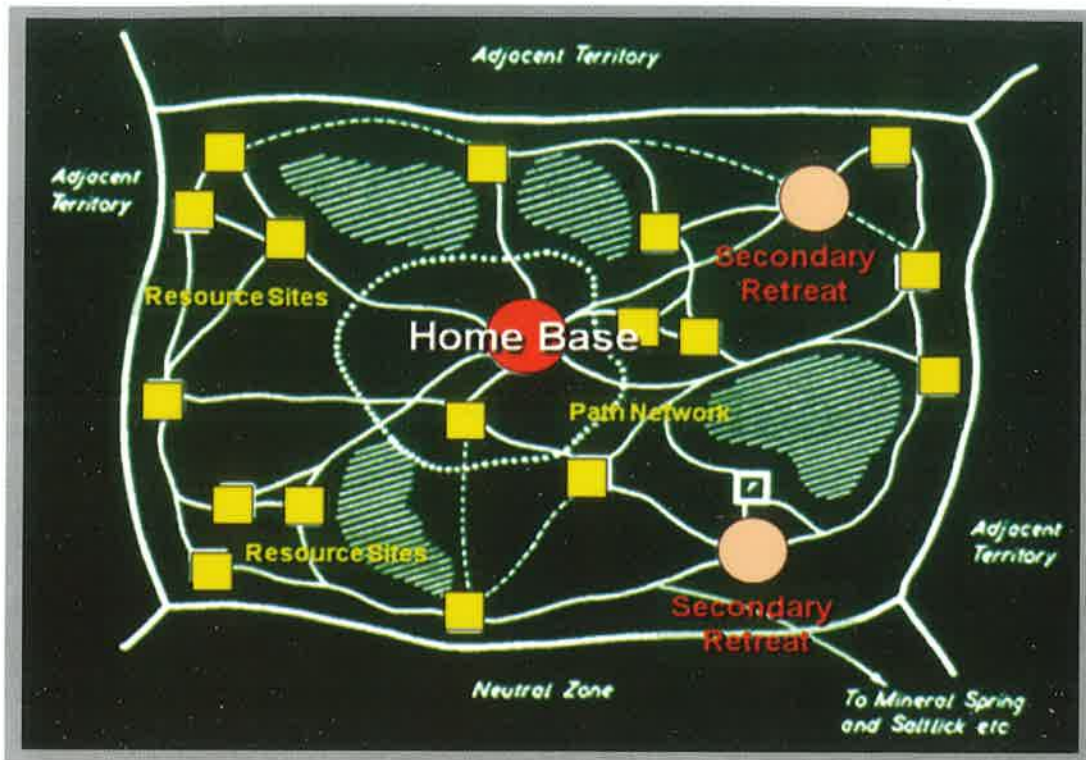
Balancing Treat Logs

Built in Features of Enduring Interest to Animals

- Self-Activated Shower
- Provides control to animals
(can be done off exhibit or on exhibit)



Animal Rotation





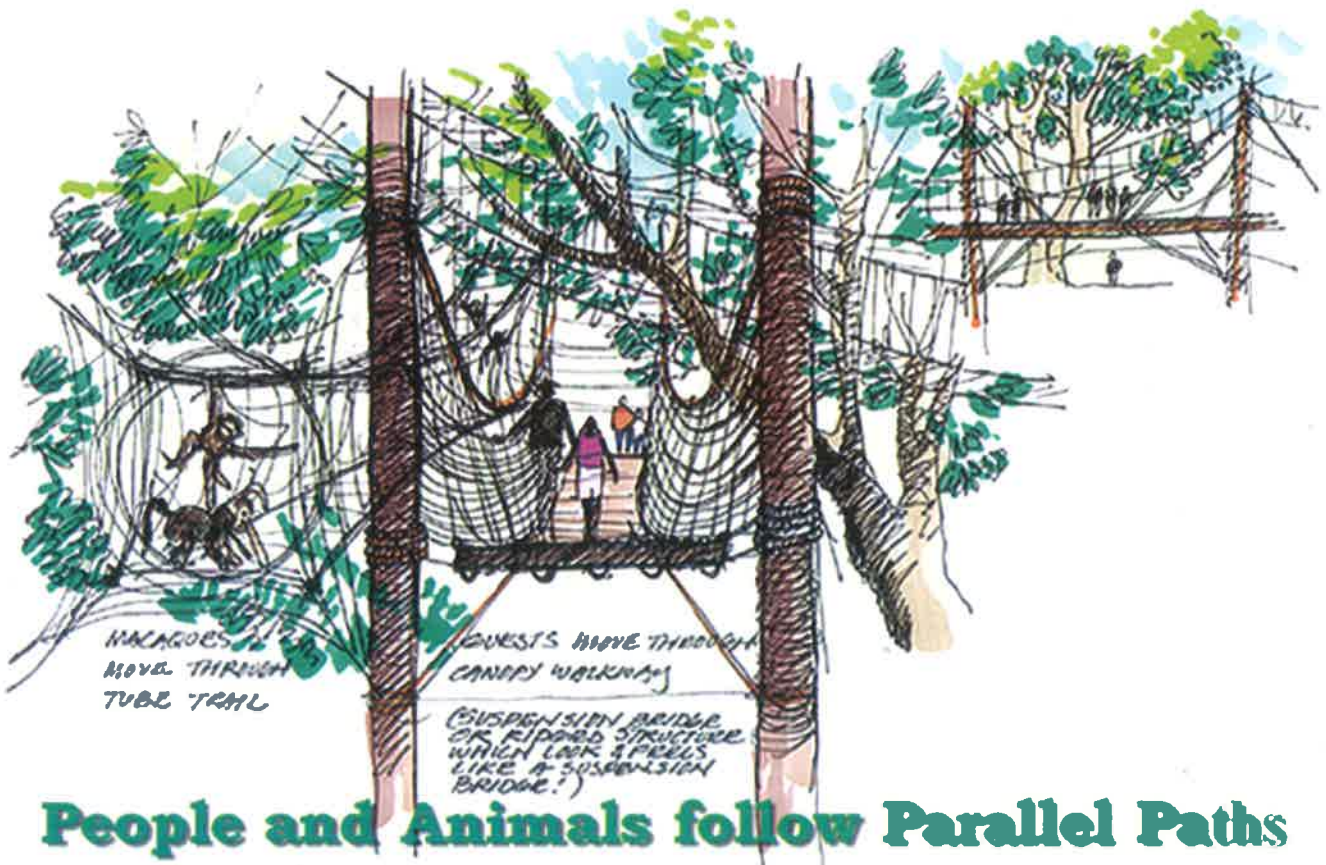
Hediger's Concept of Territory

Sanctuary Rotation

- Animal Rotation Loop
- Give area to sun, wind to distant views
- Views are important for animals
- Provide more creation in designing



Visionary Rotation Exhibit



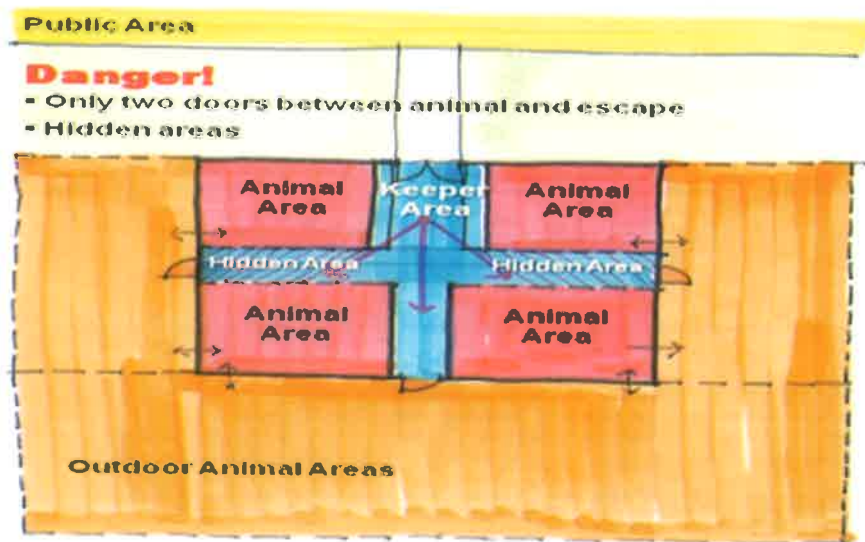


Locomotion and Exercise Choices

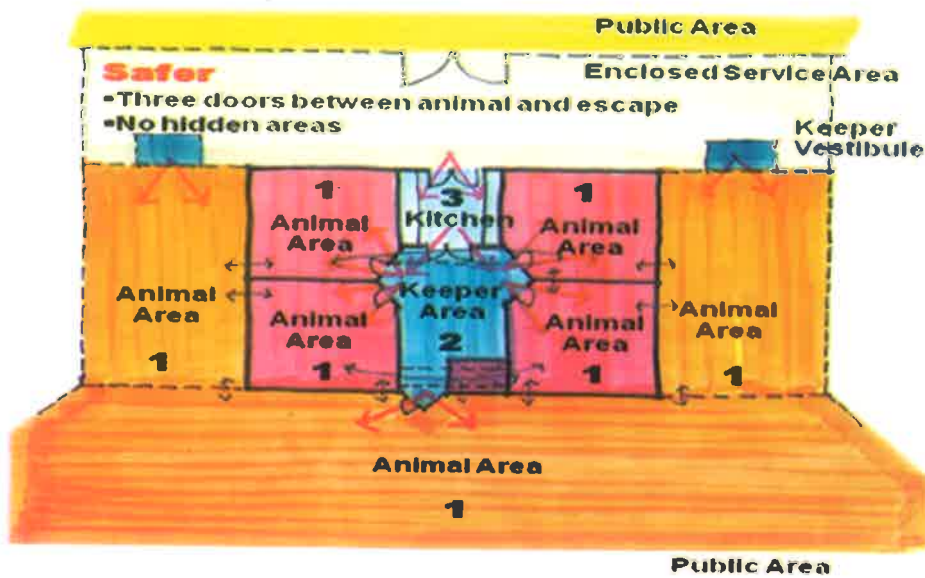
- Animal controlled access
- Varied loops and circuits
- Motivation to exercise
- Free-ranging Orangutans



Part Three Operations



Security





Blood Draw Sleeves

Animal is trained to hold paw in sleeve to receive injection or blood draw



Ex Situ Behind-the-Scenes Story:

- Experience of back-of-house tour or conservation and breeding centre
- Preparing animal for reintroduction
- Either naturalistic or artificial enrichment

Green Design



Green Roof for Zoo Entry Building

Deep Green Design

Sustainable Engineering Systems





Part Four Safari Park

Themed Transport



Driving through the Swamp



Drive through Tiger Exhibit



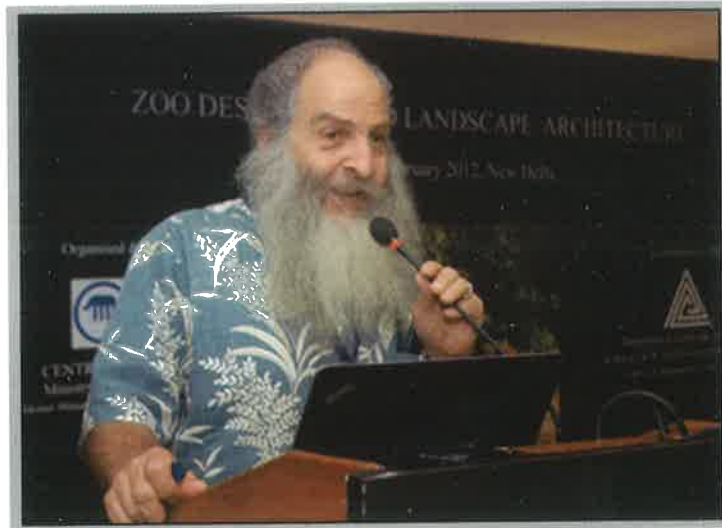
Safari Bungalows





ZOO ENVIRONMENTS FOR PEOPLE PLANTS AND ANIMALS - II

PRESENTED BY –



Mr. JON COE

- MASTER OF LANDSCAPE ARCHITECTURE
- FOUNDING PRINCIPAL, 2004 -JON COE DESIGN, PTY. LTD., HEALESVILLE, VICTORIA, AUSTRALIA

Zoo environment for people and animals

World is changing and what world we want to create

Message from animals is cage

Old thinking of zoo objectives

- Conservation
- Recreation
- Research
- Education

But updated six objectives of zoo

- Conservation (Animal Perspective)
- Recreation (Visitor Perspective)
- Research (Scientific Perspective)
- Maintenance (Worker Perspective)
- Business (Financial Perspective)



Recreation and Education

The Visitor Experience and Learning

Zoo design philosophy

- Modernism
- Landscape immersion

Functional modernism

Use of science and technology

- Keep in mind the requirement of animals
- We should not hold back animals
- Animal can do amazing things
- Thus the message is dignify animals , vision
- All messages are worth telling

Theme modernism – natural movement possible through hi tech materials

Hidden modernism – animal can live without getting known that they are being watched.

Post modernism – proper message should be sent out properly

Landscape immersion

- Animals as incompetent, dangerous and dependent
- Animals kept as objects
- Animals are part of ecosystem
- Animals as competent, independent and to be respected and conserved

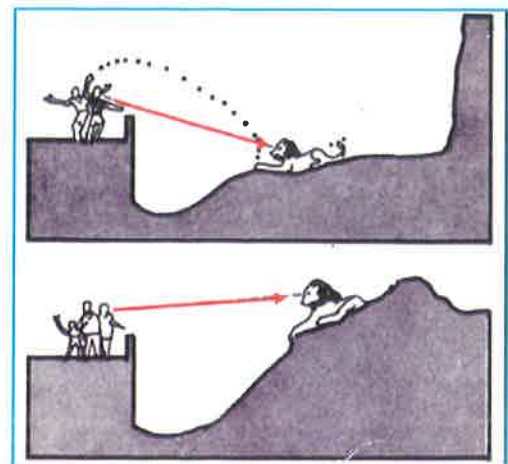
The beginnings of Immersion 1976

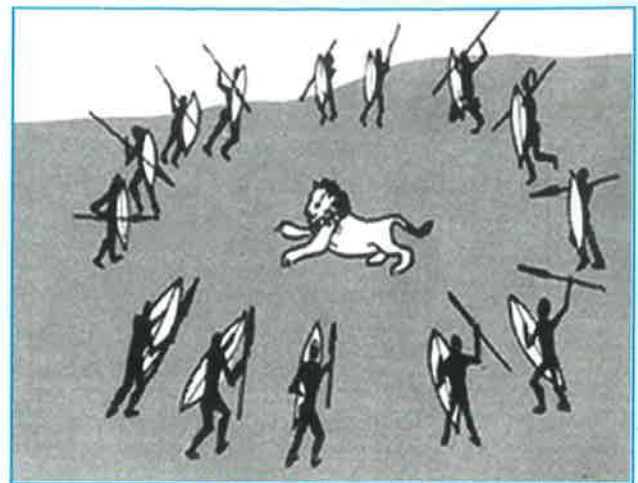
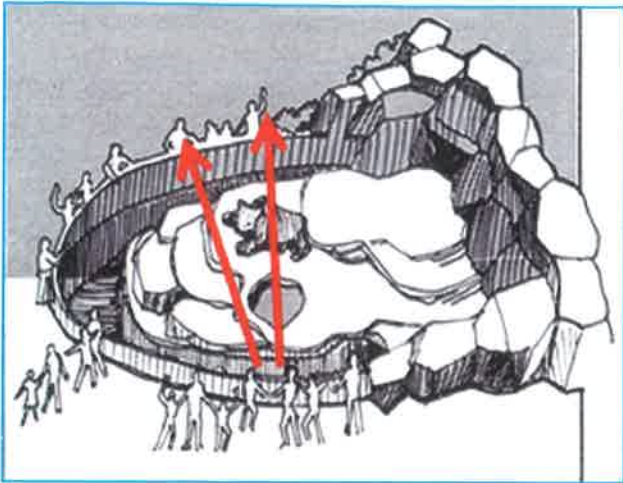
The first immersion gorilla exhibit was opened at Woodland Park Zoo, Seattle, US in 1976. Visitors enter the gorillas' forest before encountering the apes themselves.

Nature is the model .Children clearly understand the message: "Animals and landscape are inseparable."

Applied Psychology

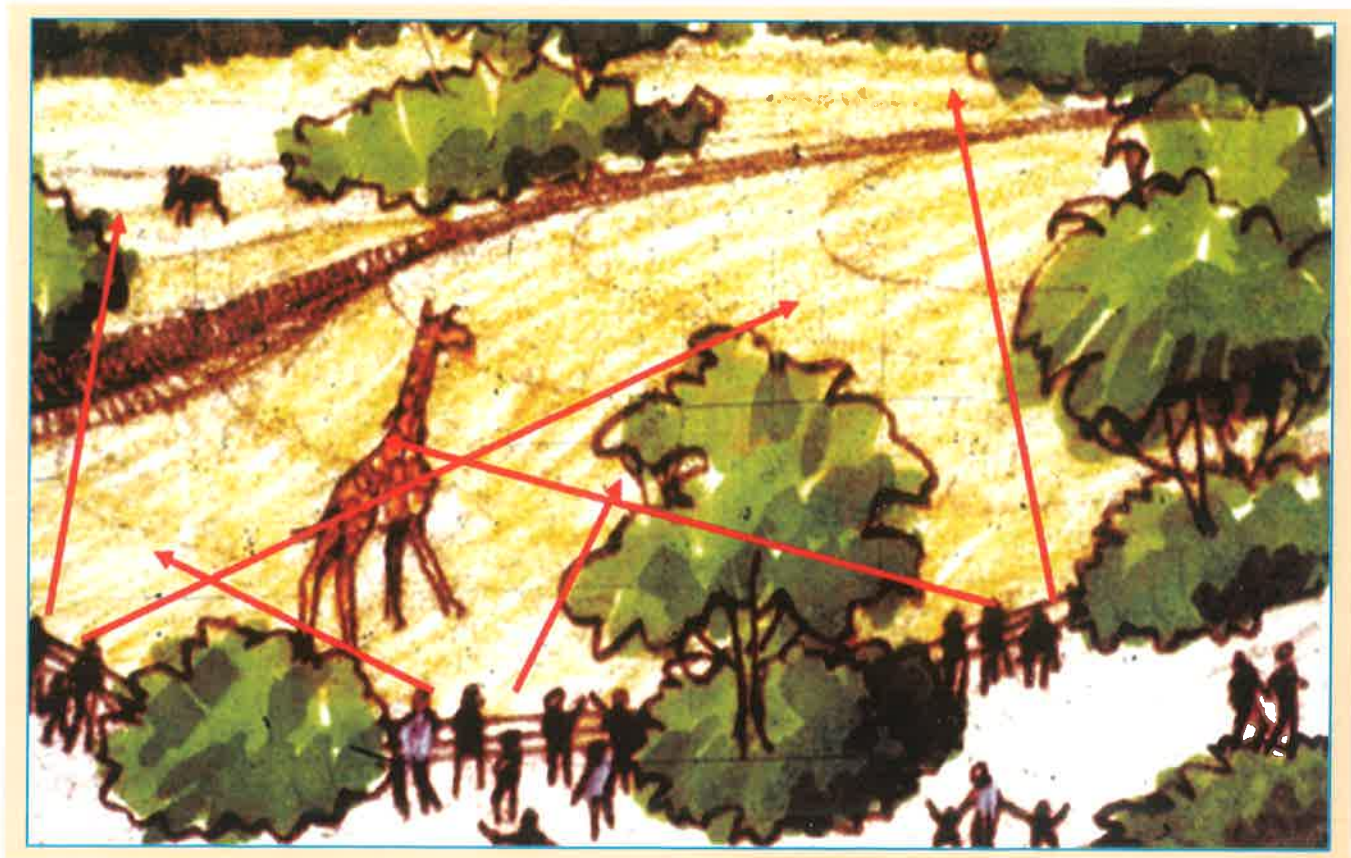
- People in a dominate position want to direct and control.
- People in a subordinate position are more likely to learn.
- People throw things
- People looking down on animals want to control them.
- People looking up to animals may respect them more.

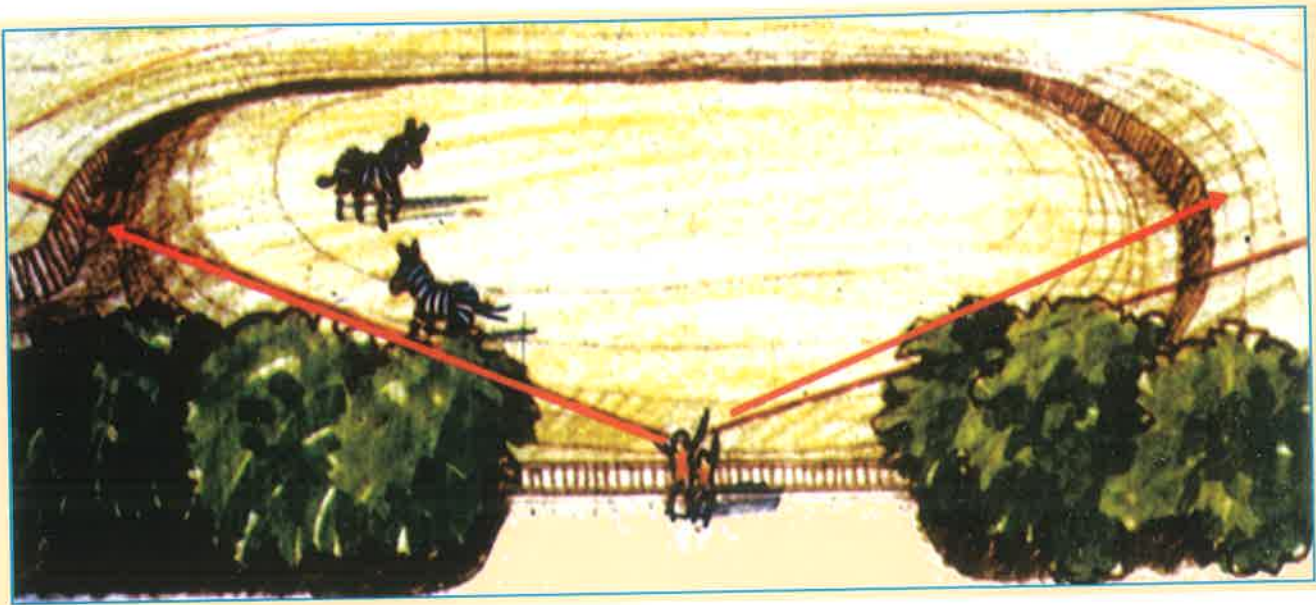




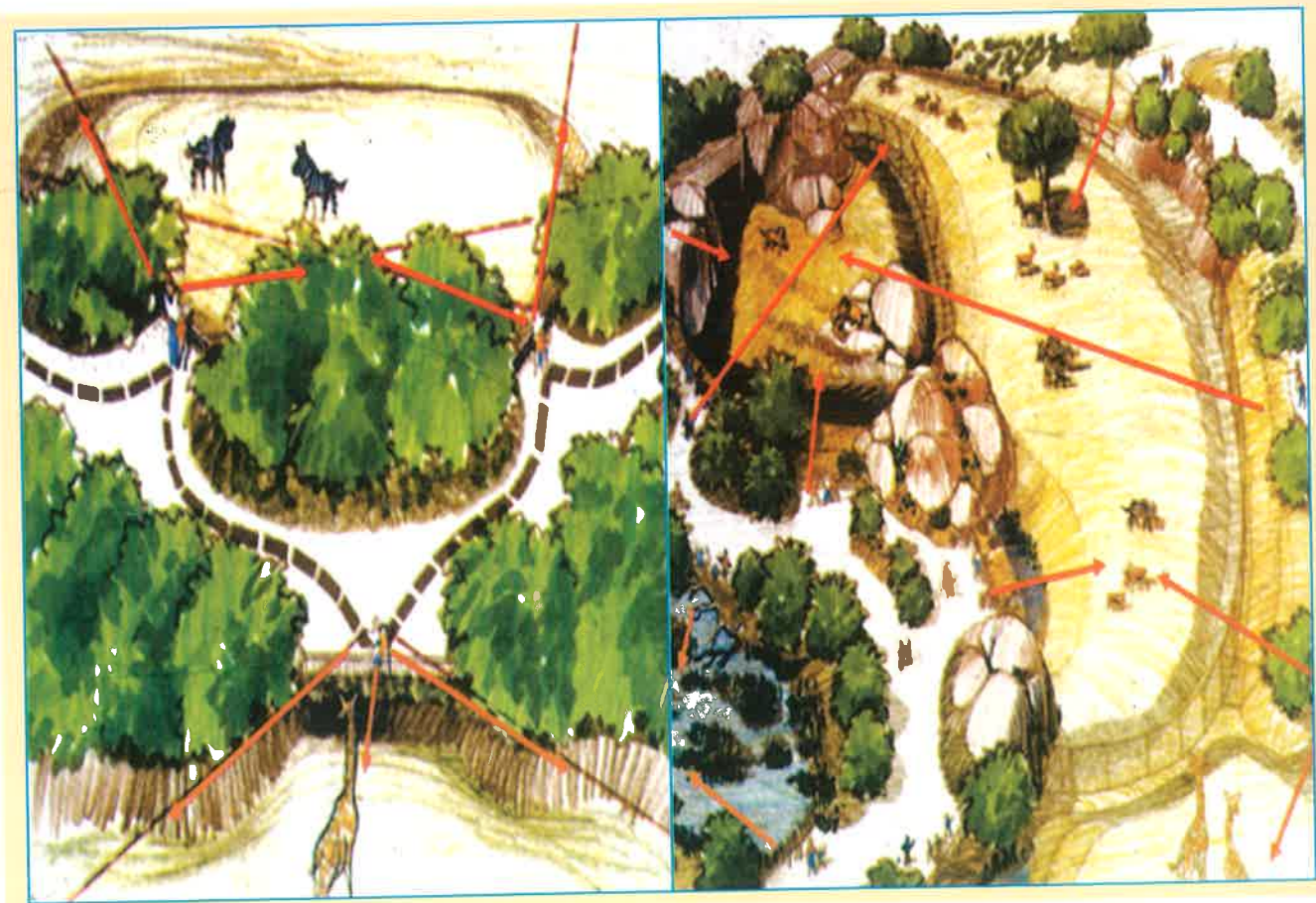
Landscape Immersion Design of Views and Sight Lines

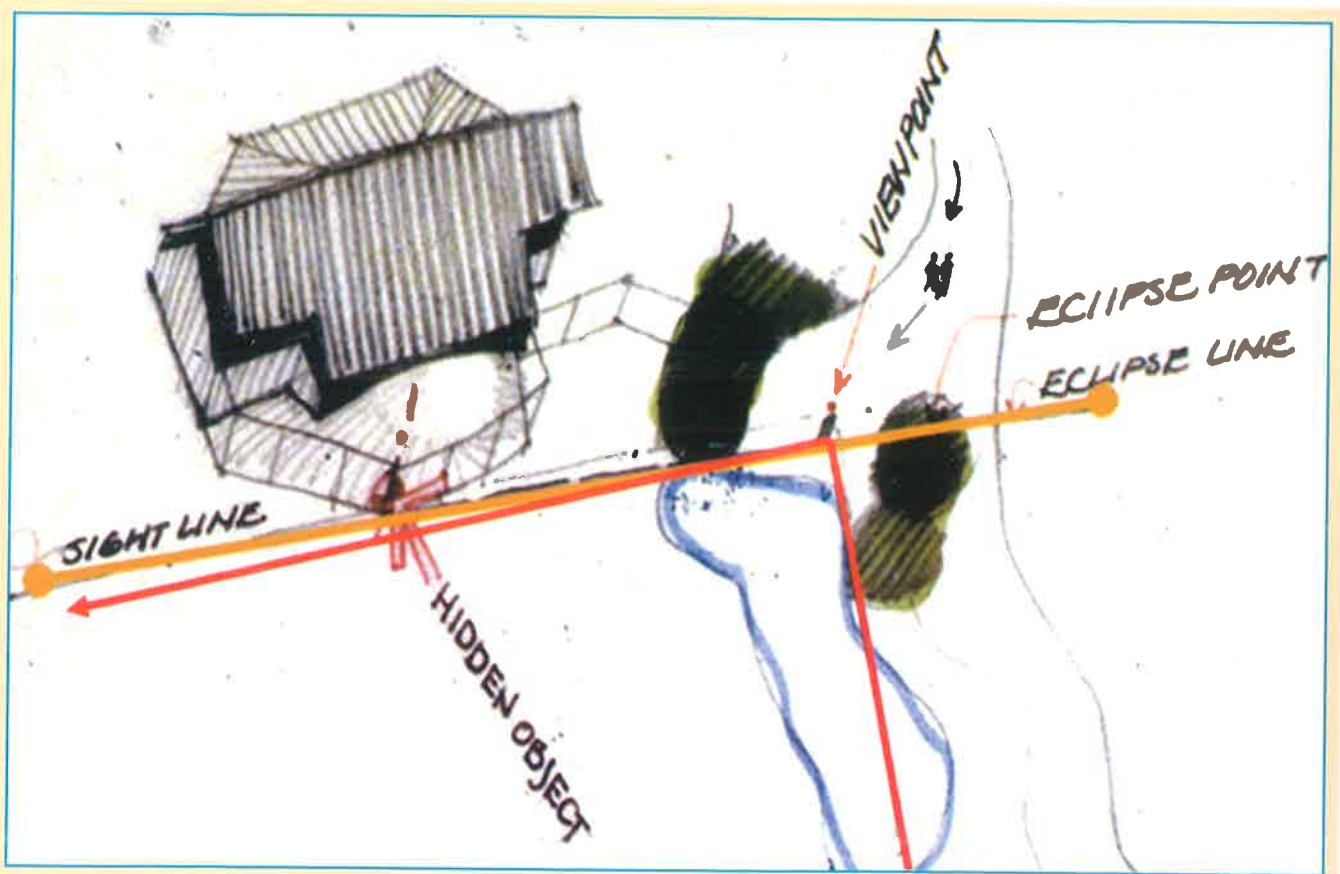
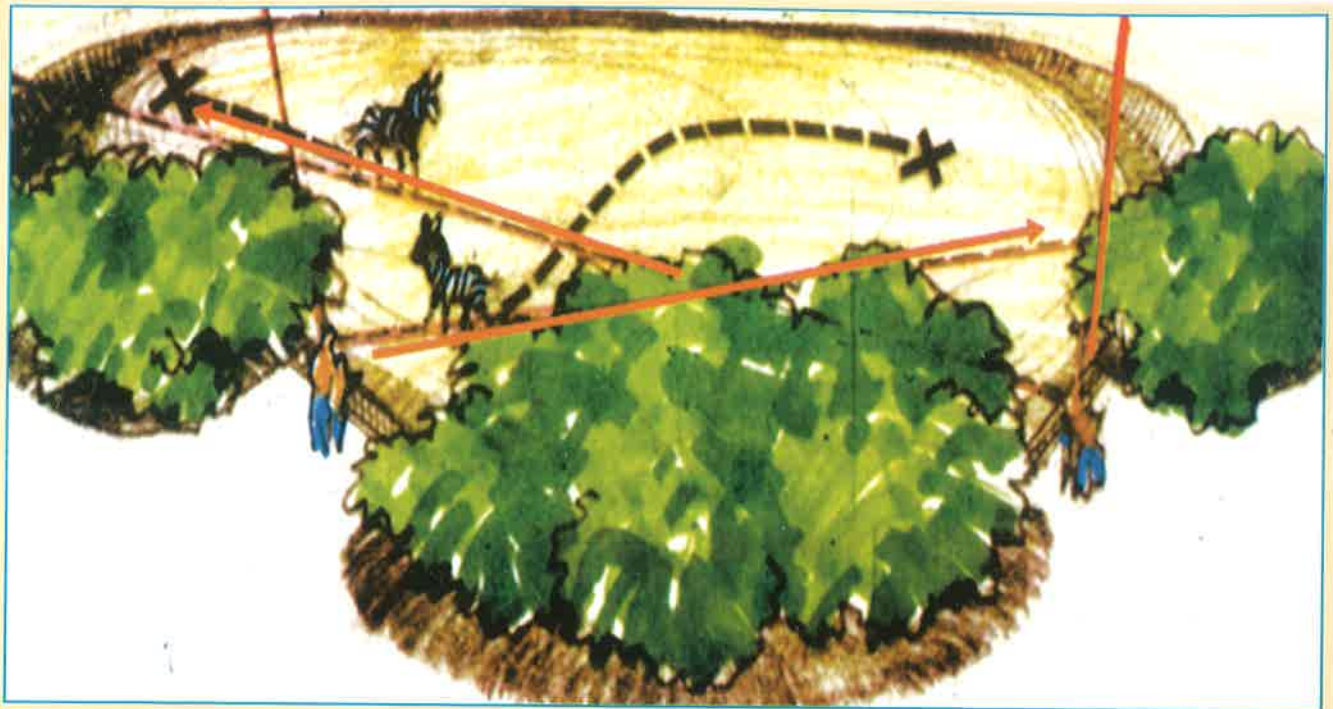
- Break up viewers into small groups
- Avoid cross views
- Don't allow entire exhibit to be seen

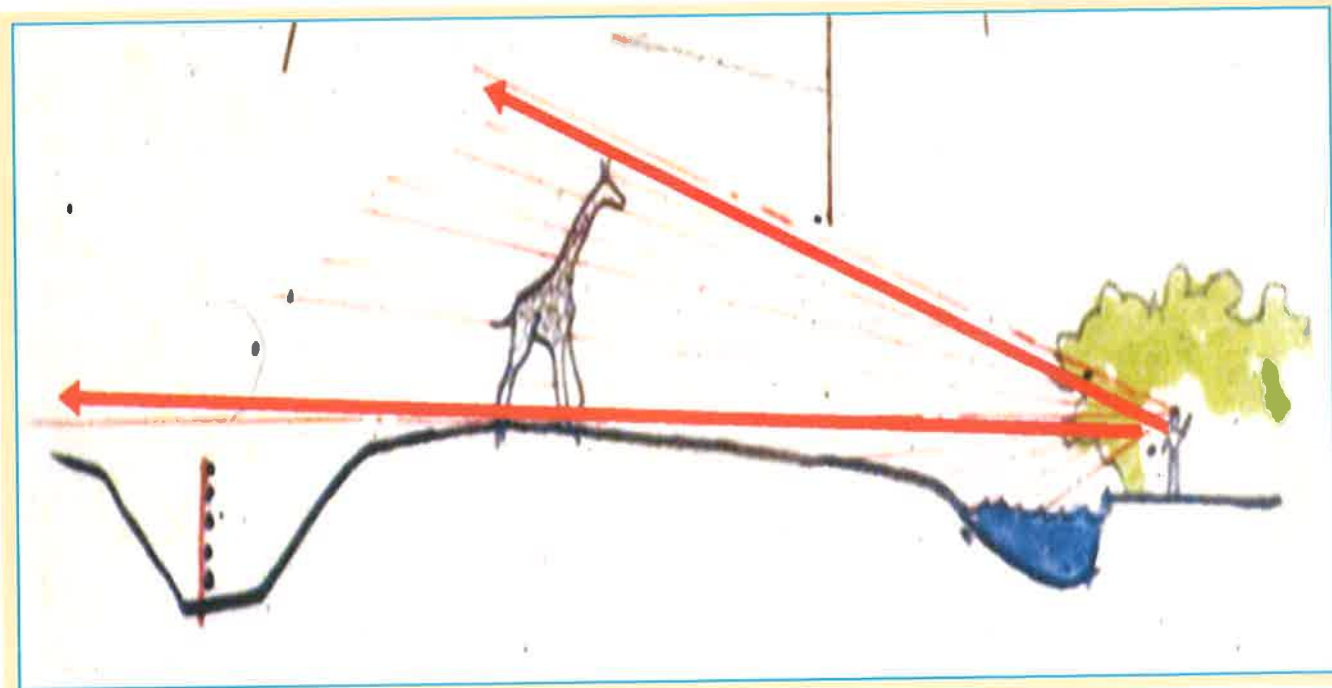
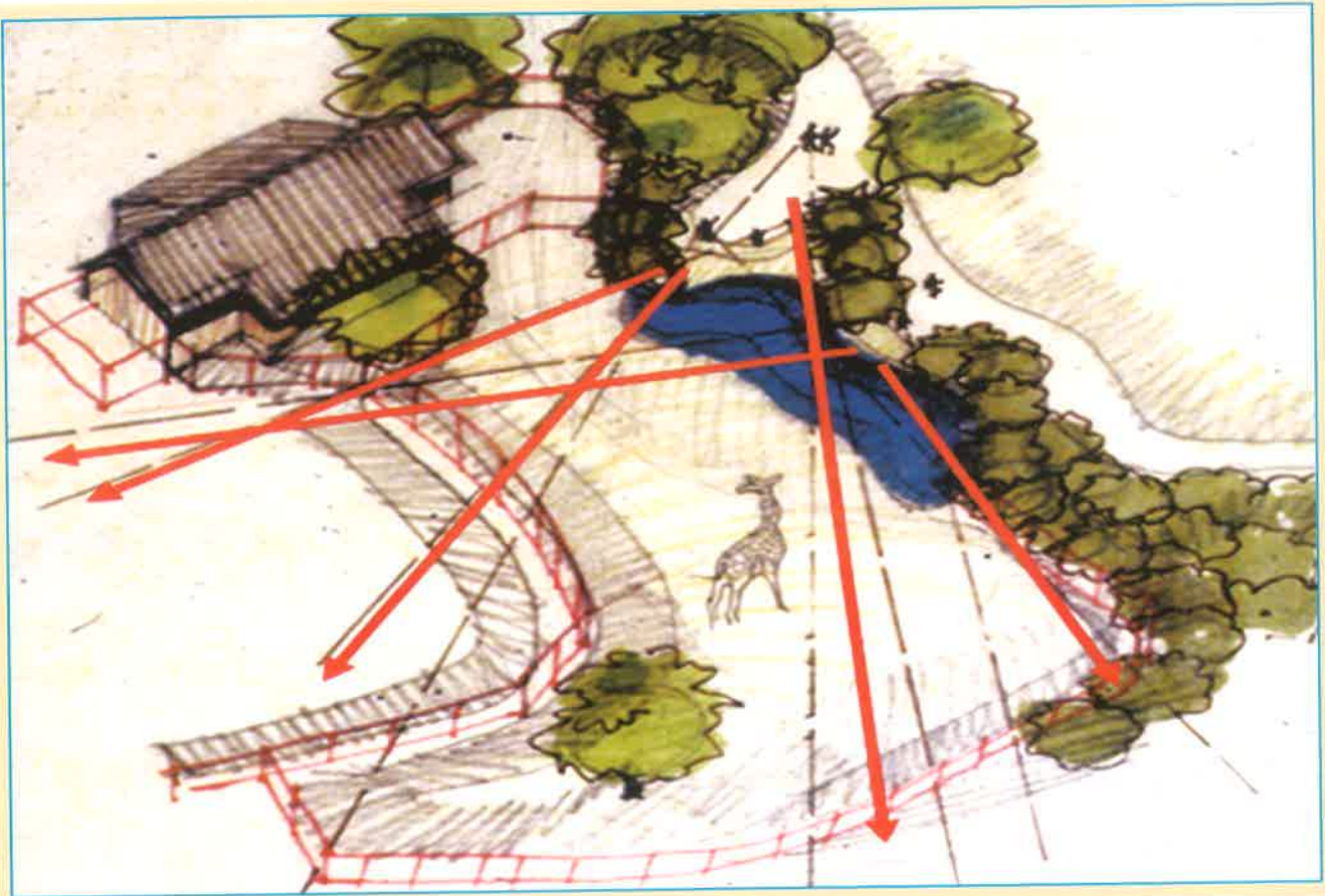


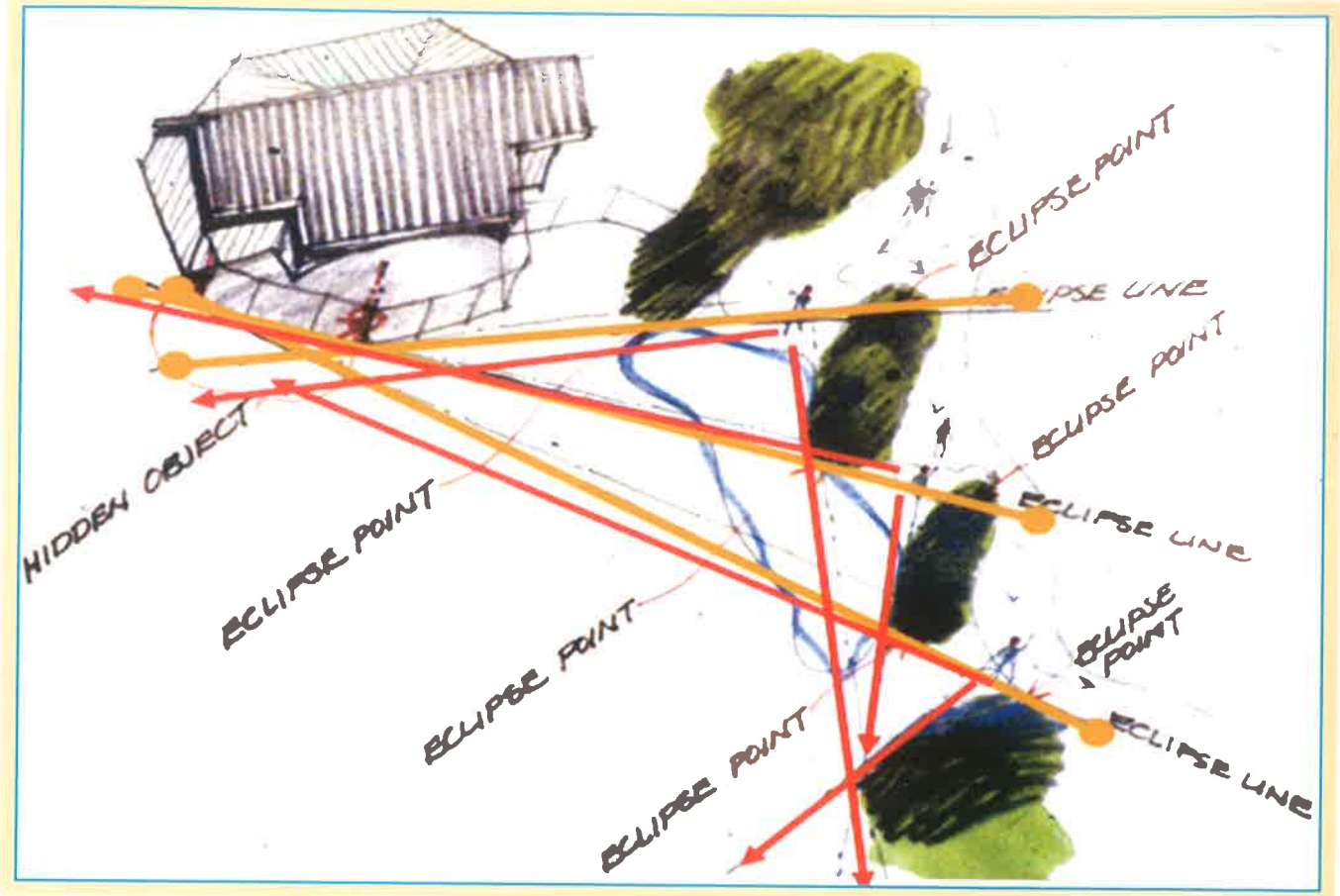


- Allow the visitors to appear to move through the animal areas
- Plan using these concepts

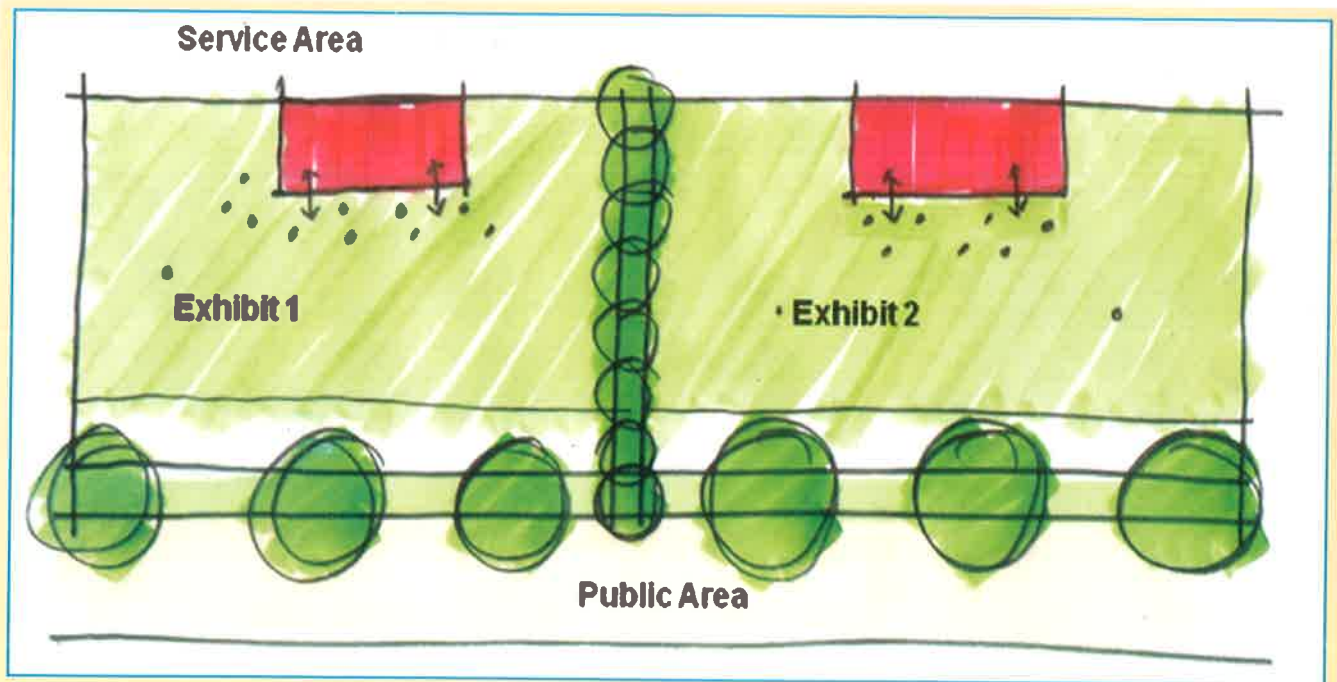


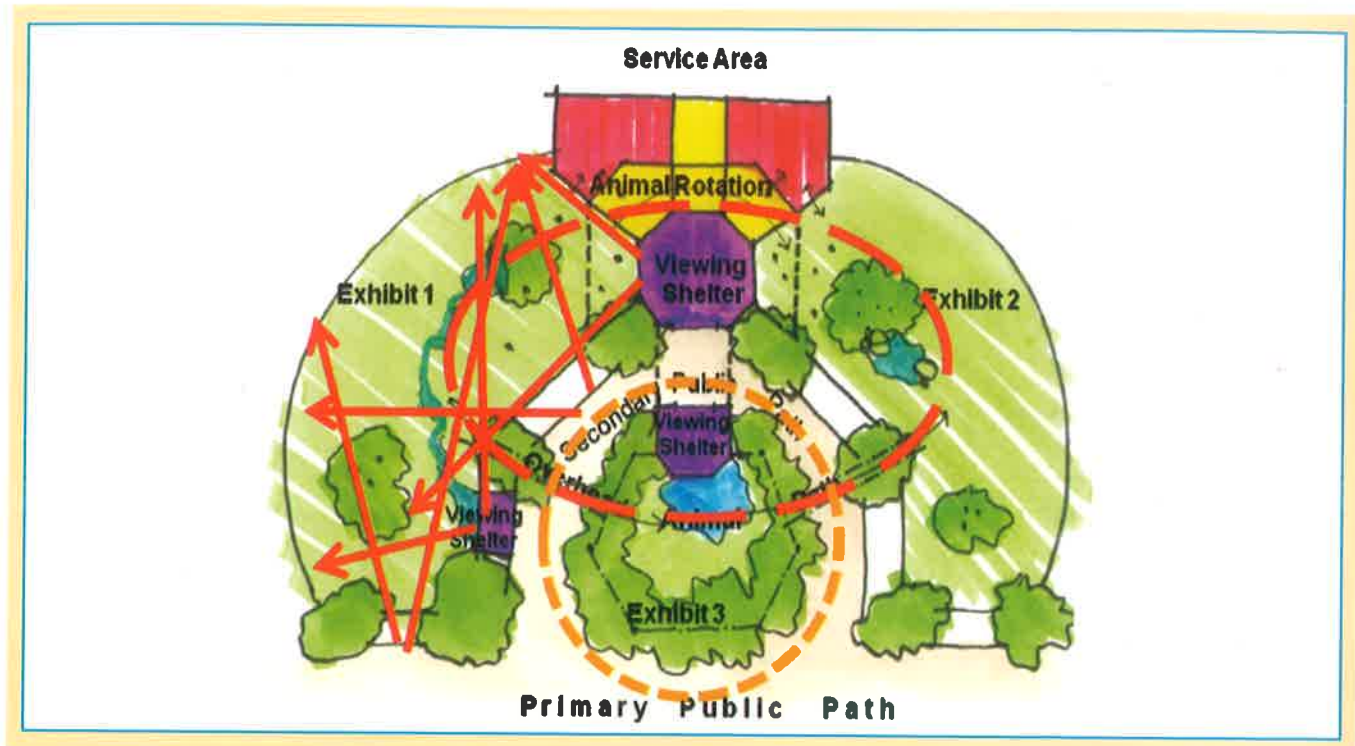






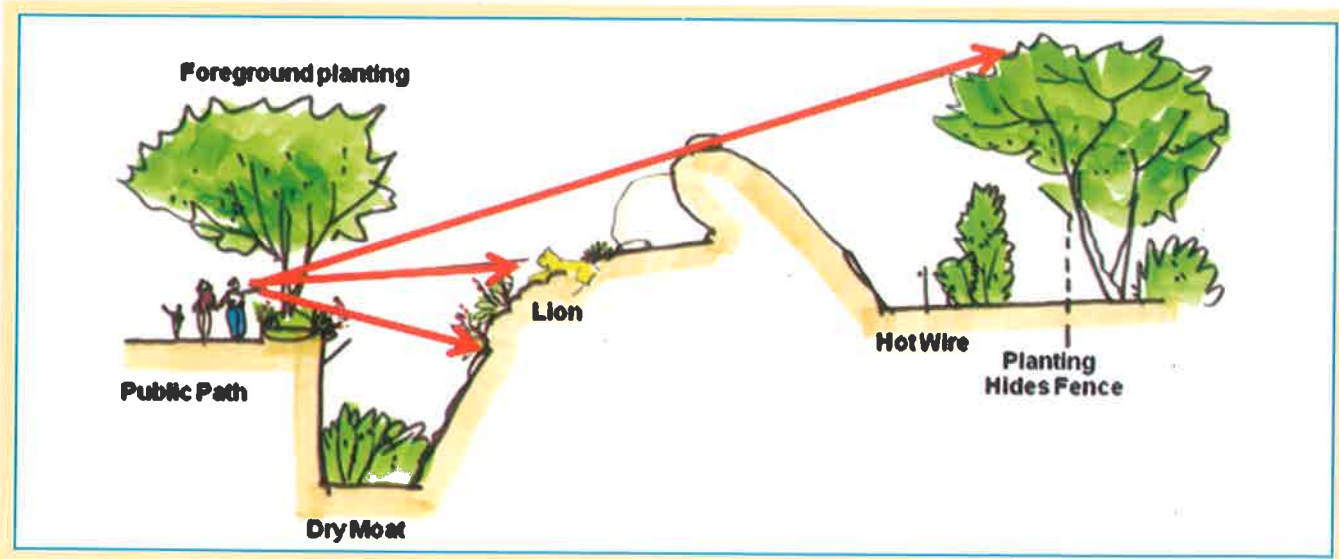
Traditional Style





Barriers

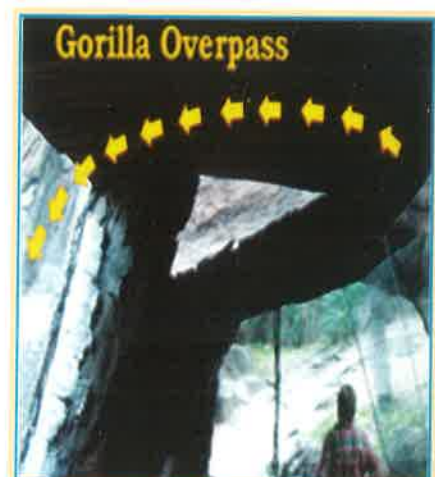
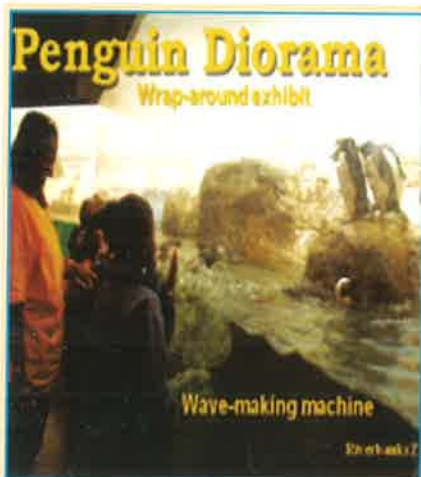
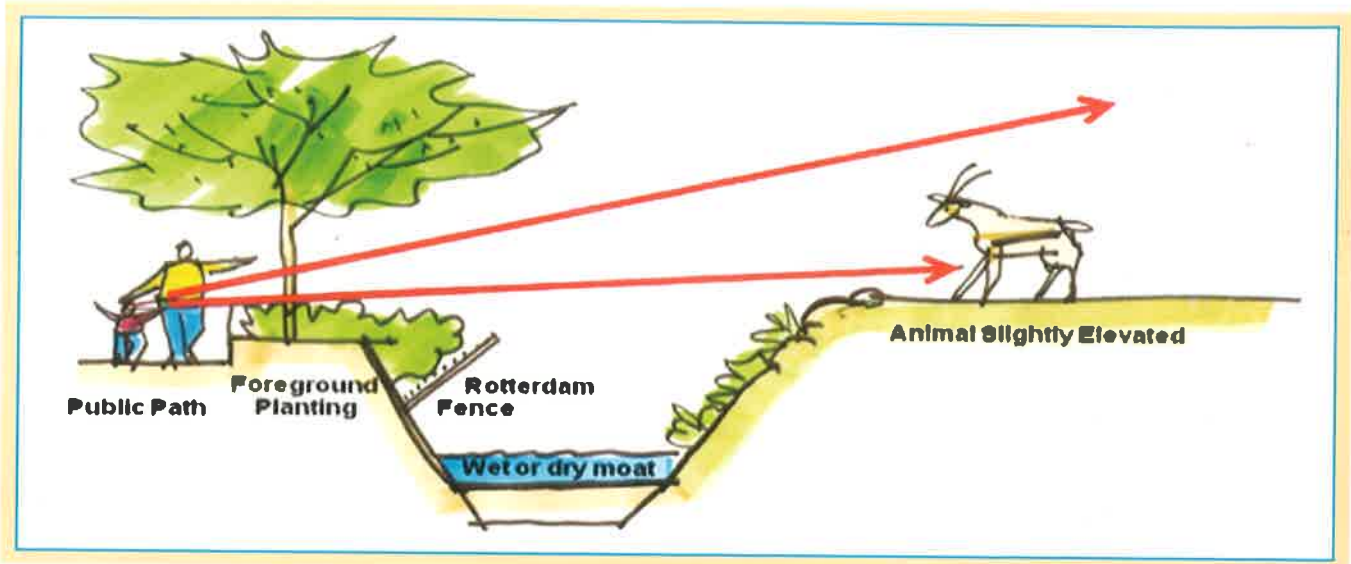
- Hidden Barriers
- Back area hidden by planting
- Animals slightly elevated
- Naturalistic moat
- Barriers can look like grass





Viewing shelter

- Viewing shelter with overlapping views
- Viewing Shelters and Mini-Museum
- Large Walk-through Aviary



Cultural Immersion

- One should be respectful to the culture
- Experience of seeing animals in vernacular, cultural setting
- Message of interdependence of animals of people and human domination
- Naturalistic and vernacular enrichment

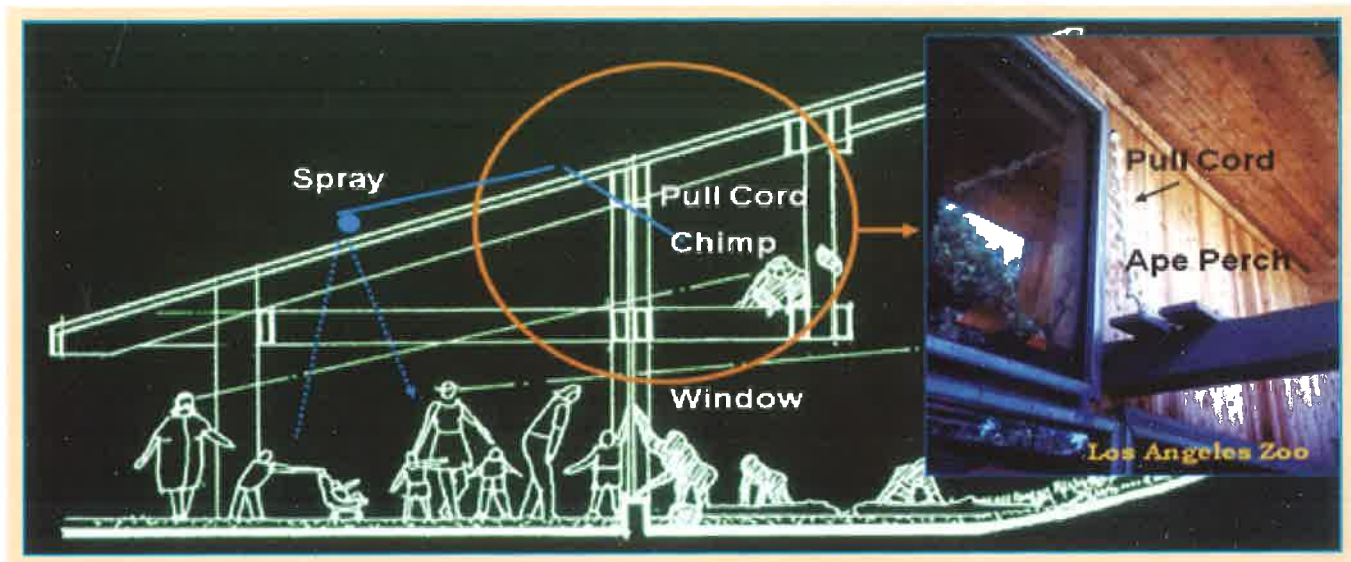


In Situ Sanctuary Story:

- Experience of visiting animal sanctuary
- Could combine animal dependence (reserve animals) and interdependence (collaboration with wildlife)
- Either naturalistic or artificial enrichment

Affiliative Design

Chimpanzees share a simulated camp converted to a sanctuary with zoo visitors



Special Viewing Opportunities

- Free flight theatres
 - We can see real life natural behaviour
 - Conservation message
- Public can feel wild birds
- Viewing animals from restaurant
- Give physical fitness to animals through design like round play, water





PECULIARITIES OF PLANNING ZOOS

PRESENTED BY –



MONIKA FIBY

- MASTER OF LANDSCAPE ARCHITECTURE
- FOUNDER OF THE ZOOLEX ZOO DESIGN ORGANIZATION

TASKS OF ZOOS

- conservation
- education
- recreation
- research

DEFINITIONS

Enclosure: Space that has been enclosed for a purpose, commonly an animal exhibit or holding area.

Exhibit: Something shown to the public. In educational discussion the term "exhibit" often derives its meaning from its historic connection to museum exhibit design. Thus it is used to describe a well-defined object, display or group of displays. In terms of immersion design it has a broader meaning, including the entire environmental surrounding. This could include everything from the



surfacing underfoot to the themed character interacting with guests to vistas of distant landscape, and, of course, the animals being displayed.

Habitat: The type of environment in which an organism or group of organisms lives or occurs. Recently used as a synonym for animal exhibit.

Immersion: Complete attention; intense mental effort; to plunge into something that surrounds or covers.

Landscape Immersion Exhibit: Immersion exhibits and the allocated visitor area are replicating the natural habitat of the animal exhibited. Animals and visitors share the same environment. Visitors are immersed into the animal's habitat. An impressive presentation of the mutual dependency of animals and their environment should predispose visitors to respect animals and their habitats.

Naturalistic: Representing what is real.

Natural: Existing in or produced by nature; not artificial or imitation.

Theme: The subject of the overall presentation or experience; the overall character-giving concept.

Storyline: The narrative or pictorial sequence of active events or experiences envisioned in a themed setting.

Context: The exhibit viewers' perceptual surroundings. This is everything that exhibit viewers perceive consciously or unconsciously while experiencing an exhibit.

Content: Intended communication. Basically, this is what interpretive signs say. It is the cognitive information that the zoo or aquarium wants people to perceive, understand and remember.

Message: The actual communication received and remembered by zoo visitors.

This may include the (cognitive) information, concepts or ideas that the visitor gleans from the actual interpretive information, filtered through the (affective) context of the setting and the distractions, prejudices or attitudes of visitors themselves. The message that counts most is the one the visitor remembers. The importance of clearly and finitely defining the "message" as the first step in the exhibit design process requires the entire team of designers, educators and other stakeholders to participate in framing the intended message.

Enrichment: Provision of stimuli which promote the expression of species-appropriate behavioral and mental activities in an under stimulating artificial environment. The process of creating an environment that addresses an animal's social, psychological and physical needs. Enrichment aims to enhance animal activity and to provide stimulation.



ZOO USER GROUPS AND THEIR NEEDS

Zoo Animals' Needs

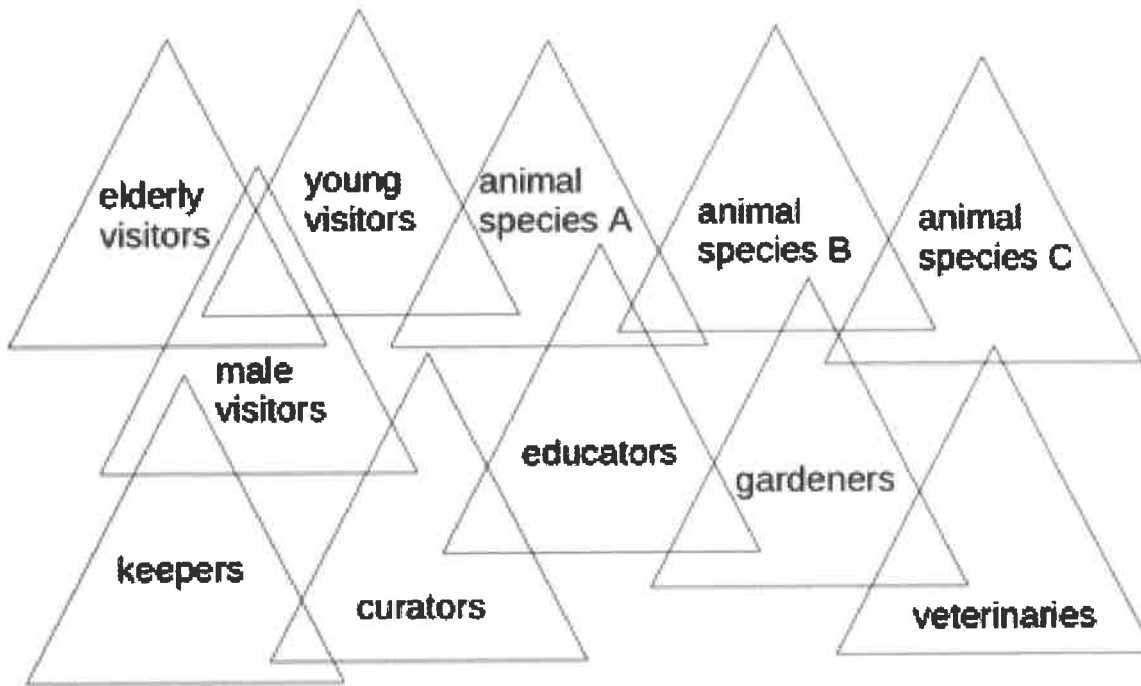


ZOO Animals' Needs





The planning of zoos is one of the most complex design tasks because it should serve various user groups with partly conflicting needs.



ZOO PLANNING AS COLLABORATIVE WORK

Participating and affected groups and their interests should be represented in the planning process:

- Animals (zoology, veterinary science, conservation)
- Visitors (service, entertainment, safety, education)
- Personnel (working conditions, safety, security, food)
- Horticulture (shade, aesthetics, education, enrichment, food)
- Marketing and Public Relations
- Finance (owners, sponsors)
- Administration (management)
- Consulting, Planning, Coordination



PURPOSE OF ANIMAL EXHIBITS

Purpose	Content
Education about	taxonomy (cats, bears) animal geography (Africa, Masoala) animal ecology (forest, savannah) animal habitat (canopy, water edge) endemism (Madagascar) animal behavior (burrowing) animal sociology (wolf pack) animal use (domestic animals) species conservation (EEP) in-situ projects (bald ibis)
Attractivity due to	charisma (panda) topicality (Nemo) size (giraffe) behavior (monkey) posture (penguin)
Animal contact	petting zoo
Animal conservation	participation in a breeding program
Animal protection	rehabilitation
Animal research	special features incorporated

The design of an exhibit should reflect its purpose.



THE PLANNING PROCESS

The development of a zoo project plan is a cyclical process:

The findings from one step can inform and improve upon the conclusions from a previous step. Repetition and re-thinking of steps will lead to the best and most coherent outcome.

Inventory + Analysis



Goals + Priorities



Message + Themes



Spatial Organization



Project Development



Schedule + Budget

PREREQUISITES FOR PHYSICAL ZOO PLANNING

Inventories:

- Animals (species, age, sex, peculiarities)
- Trees and shrubs (species, age, condition)
- Buildings and exhibits (use, age, condition)



Statistics:

- Visitors (distribution, age, sex, language, group size)
- Use of visitor service facilities (parking, gathering spaces, resting areas, toilets, eating and shopping opportunities)
- Deliveries and waste management (food, trash, manure, recycling)

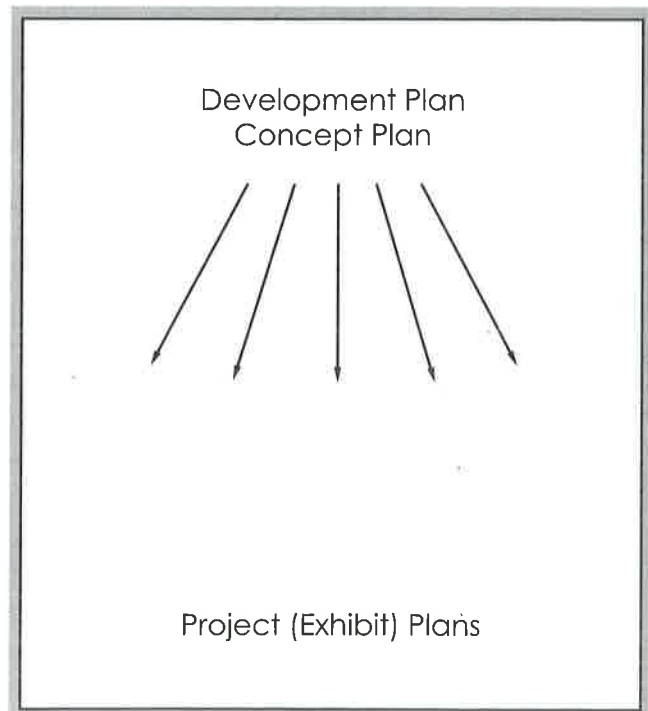
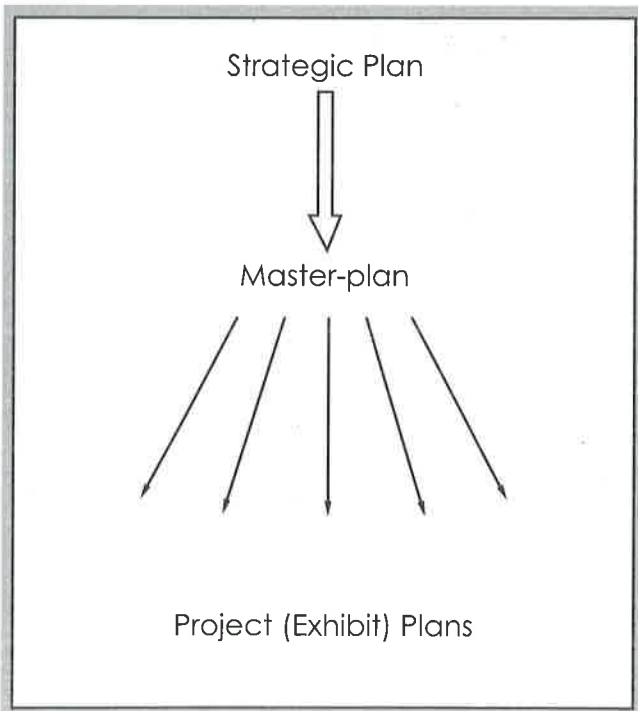
Survey Plans:

- Buildings, pools, trees etc.
- Utility lines
- Floor plans

Descriptions:

- Personnel (responsibilities, expertise)
- Resources (cost effectiveness of water and energy supply, drainage and sewer systems, garbage and waste treatment)
- Pathways (surface material, drainage, condition)
- Safety/security provisions and procedures
- Education facilities and activities
- Research activities

THE ZOO MASTERPLAN AS PART OF ZOO PLANNING

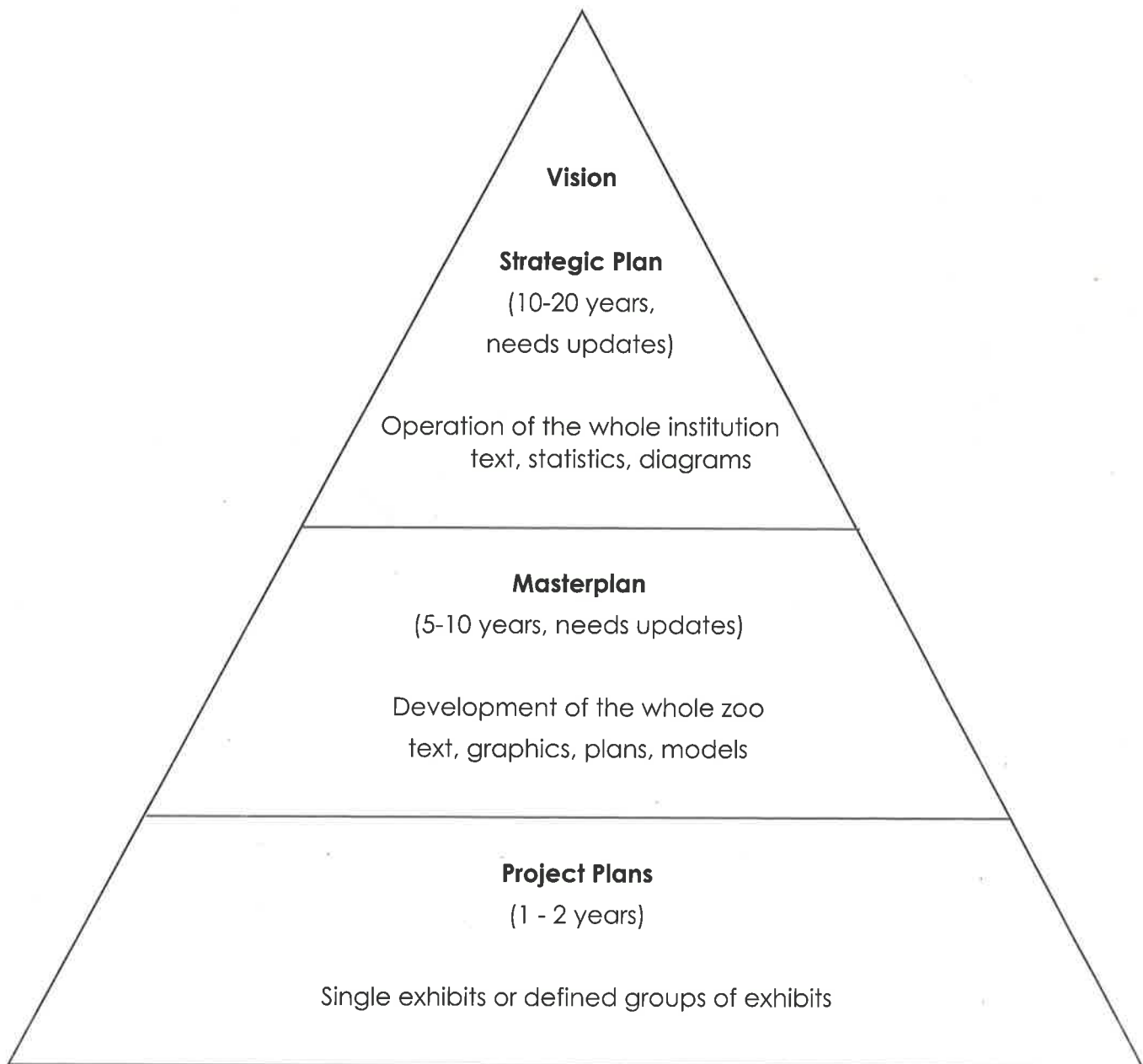




USES FOR A ZOO MASTERPLAN

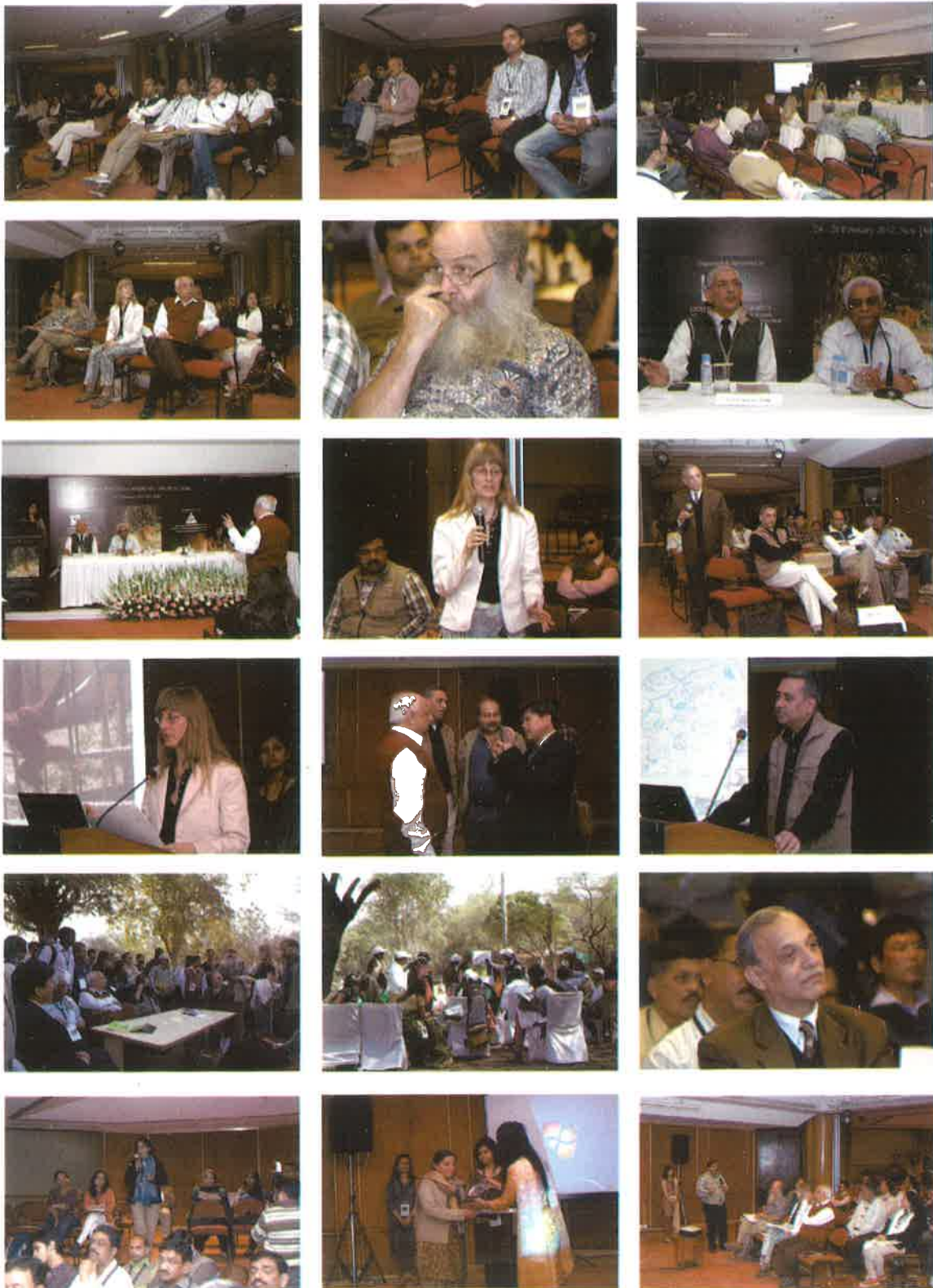
- Information for new staff
- Information for visitors (marketing tool)
- Information for investors (fundraising tool)
- Basis for exhibit designs
- Background information for external designers and consultants

SCOPE OF A ZOO MASTERPLAN





Pictorial glimpse of the session as take to back (Picture groupe of the trang program)



DAY - II



MASTER PLANNING FOR DEVELOPMENT OF ZOO: INDIAN PERSPECTIVE

PRESENTED BY –



Mr. S C SHARMA

- FOUNDER MEMBER SECRETARY, CZA

Current environmental scenario:

- Shrinking Glaciers , Dry Rivers
- Denuded Hills , Infertile Agricultural Fields
- Air & Water Polluted , Sick People
- Natural Calamities Like Tsunami & Earthquake
- Climate Change & Ozone Hole
- Increasing Number of Vehicles, Polluting Industries

We must be very careful about the environmental changes. We must strive to make today a little better than yesterday, so that we can enjoy tomorrow.

Vision of Indian zoos:

- Green hills, clean rivers & fertile planes
- Ambivalent air, potable water & wholesome food for all generations
- Rich biodiversity for healthy environment
- Sustainable utilization of natural resources for secure future of mankind



Suggested Missions for Indian Zoos:

- Enhance environment / conservation awareness in the country
- Muster support for sustainable, judicious & efficient utilization of natural resources
- Motivate masses for minimizing wastage and its scientific /sustainable disposal

Strategy for achieving the mission:

Provide visitors opportunity to closely interact with nature through:

- Display healthy wild animals exhibiting their species specific behavior in nature's emerging enclosures
- Create sylvan surroundings in the zoo.

Showcase water/energy saving devices & waste disposal procedures

MASTER PLAN

Road map of strategies and activities to achieve the specified vision & missions in a given time frame. What do we do, for whom & how to ensure that we excel in what we do.

Master planning

- It is a statement of strategies , policies & guidelines that are flexible and responsive to the ground realities
- Constant monitoring and midcourse corrections are crucial for the successful implementation of master plan.
- Ownership & commitment are key to the success of the master plan

A master plan can be described as following

- Is a plan to achieve a vision.
- Protect the environment, improve productivity, performance
- Is a contract between interested parties
- Government, engineers, regulatory agencies, end users, public
- Looks at the big picture, that is a forest not a tree
- Concentrates a set of projects not one project (program)
- Is a roadmap to bring pieces together
- Bring all projects together to serve one vision.



Core organizational values

- Conserve & protect local physical environment
- Zero impact on natural resources.
- Highest standards of animal welfare
- Safe/ conducive working environment for field staff
- Courteous and responsive behaviour to visitors
- Encourage participation from local communities/ body's

Experts to ponder & decide

- Money can grow trees in deserts and make water flow through sand dunes, what experts should be doing? Produce these white elephants or buildup simple, flexible and functionally efficient infrastructure

Do not try impossible

- While constructing a zoo anywhere, do not try to keep animals which can thrive well in the local climate
- Never try to obstruct the natural drainage of the area through execution of master plan
- Bringing water in uphill direction for long distances



Fig: Construction across the steep slope without due safeguards can be disastrous



ANIMAL COLLECTION PLANNING:

- Keep in your animal collection only such species & such numbers that are crucial for achieving the conservation goal of the zoo
- Confine the animal collection to only those species which can thrive well in the local climate
- Constantly monitor sex ratio of the progeny, if skewed carry out research on mitigate measures
- In case of species which are not successfully breeding, use innovative methods like-manipulation of diet change of partners, enrich the enclosure; provide withdrawal areas, provision of screening plantations.
- Take help of lacones for in-vitro finalization/artificial insemination.

LAY OUT PLAN:

- Ear marking of the zoo area in to various usage zones, keeping due regard to the location, topography, vegetation and other physical features

Location map of various facilities and services on the map including location of various animal exhibits

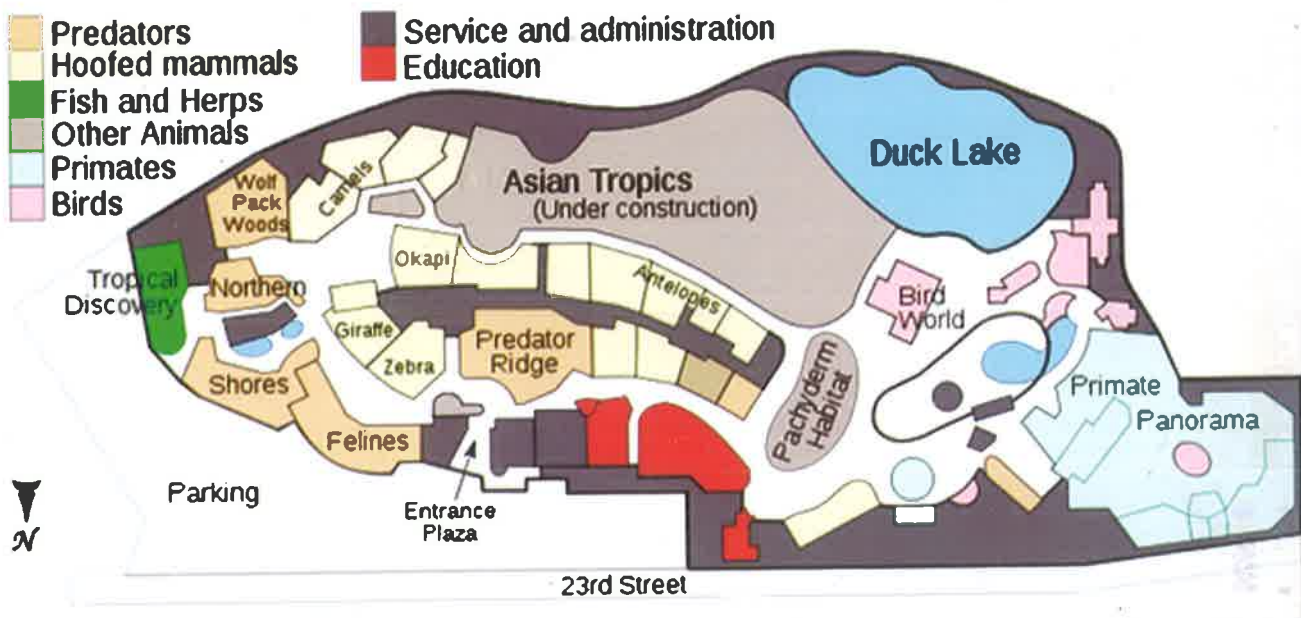


Fig: Lay out plan of a zoo



3. Remaining area to be used for animal exhibits (30% of zoo area), green belt/natural forest (30% of zoo area) and rest for visitor facilities & zoo support infrastructure
4. Organize exhibits according to a theme so that exhibits can communicate to the visitors a clear & loud conservation message, highlighting the ecological interlinkages of nature
5. Lay out of the exhibits should be such that no visitor route passes close to the feeding cells and no service road passes through the visitor area.
6. Visitor facilities should be so located that they do not mask/impact the natural ambience of animal enclosures.
7. Appropriate drainage and sewer treatment plant should be provided to ensure that hygiene of the zoo & neighboring areas is not impacted

LAYOUT PLAN:

suggestion for good layout plan

- Zoo exhibits should have visitor viewing areas only on the front side.
- The animal paddocks should be so located and designed that animals are at higher level than the visitor
- Visitor should not be in a position to view more than one exhibit at a time (that too in parts)
- Animals should be free to go in feeding cell and come out at its will

Animal exhibit designing

All about exhibiting healthy animal exhibiting their species specific behaviour in naturalistic settings

Animal should stand out in the enclosure

Hard exteriors of the enclosure should not mask the animal



Fig: Dingy enclosures are counter productive



Fig: Massive moats only do not make a good enclosure

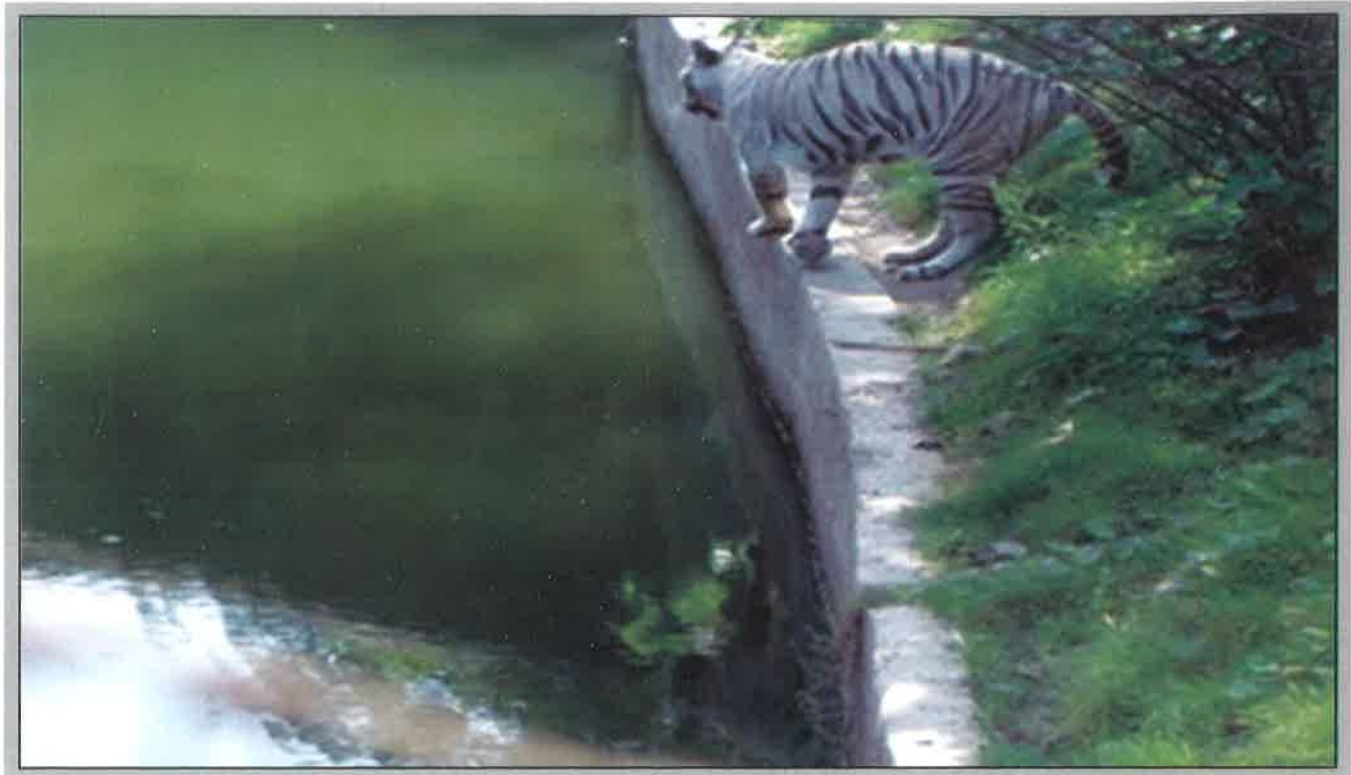
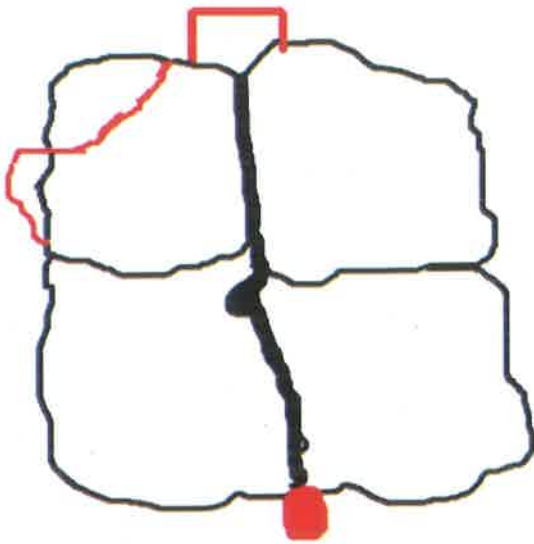


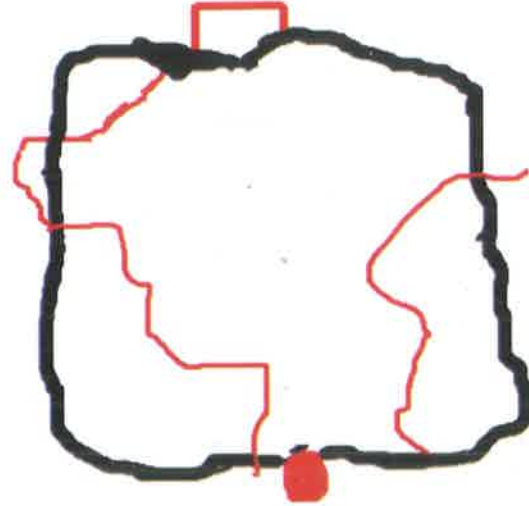
Fig: Well-designed moat

VISITOR MANAGEMENT:

1. The information provided through signage and interpretation facilities must have something to offer to the visitors from various age groups and educational background
2. Innovative measures should be taken to ensure greater involvement of students other young visitors through inter active signage's and computer based animations about animal behavior and ecological importance
3. All animal exhibits to be so designed that the chances of animal injuring/hurting visitors are totally ruled out
4. Parapet walls of the animal paddocks and the stand of barriers should be so designed and maintained that no visitor can accidentally fall in to the paddock/can harm and damage the animals
5. Earmarked visitor routes with appropriate signage
 - Visitor should comfortable , not bogged down by overcrowding or his visit being too tiring
 - Visitor amenities like drinking water, hygienic toilets should be available at reasonable distances
 - For entire stay at the zoo, the visitor should feel safe & secure. this may need public help centres at appropriate points



Mall & Loops



Loop & Sub Loops

Fig: Visitors circulation map

CONSERVATION MESSAGE:

- The message should be conclusive, precise & communicable
- Should be displayed in local language along with English
- Should be displayed at location /height that catch the visitor eye suitably matching the theme of the exhibit.
- Should enlighten the visitors about the crucial linkages between wildlife conservation and long term survival of the mankind

CONSERVATION OF NATURAL RESOURCES & NATURE EMERGING ENCLOSURES:

- Design the exhibits using minimum cement concrete & steel. Use ecofriendly materials like timber, mud, natural stones etc
- Provide natural lighting, ventilation, green roofing. Use solar energy, biogas, waterless toilets to minimize water and power consumption

CONCLUSION:

The total presentation of the zoo should be such that the visitors are convinced of zoo's commitment to wildlife and can appreciate the zoo's pursuit for excellence in conservation research & education



PRINCIPLES OF MASTER PLANNING FOR INDIAN ZOOS

PRESENTED BY –



Mr. S. K. PATNAIK

- ZONAL HEAD (EAST)
CENTRAL ZOO AUTHORITY (MINISTRY OF ENVIRONMENT & FORESTS)

ZOO MASTER PLAN

The Master Plan is a comprehensive document to guide systematic and planned development of an existing or a new zoo for a reasonably long period of 10-20 years keeping its land, financial, personnel, physical and aesthetic resources and constraints in view in order to provide holistic nature conservation education with wholesome recreation. This document helps in optimum utilization of the zoo resources in a planned manner, without being affected by individual whims, peer or uninformed public opinion and serves as a document to guide annual budgeting and personnel planning.

Master Plan of a zoo should be a comprehensive document giving a detailed road map for the plan period regarding development, improvement and up gradation of the facilities and infrastructure available at the zoo and building up of the capacity for carrying out all the operations forming part of the zoo management with greater efficiency.

HOW TO PREPARE A MASTER PLAN?

- In- House Consultation with:
 - Present Senior Zoo Staff



- Former Senior Zoo Staff
- Biologists (From Universities etc.)
- Architects and Landscape planners
- State or local Leadership
- Visitors (through documentation of their perception)
- Veterinarians
- Other Stakeholders
- Consultations to be facilitated by outside consultants, if required
- Through External Consultants :
 - When it is a new Zoo
 - When local/in-house expertise is not available
- Consultants can be provided with different inputs by the zoo management including contour map of appropriate scale to make their efforts easier.

It shall involve following steps:

- Defining mission, vision and conservation message
- Inventorize and evaluate present infrastructural facilities, resources available and shortcomings
- Identification of priority needs
- Developing implementable action plan with estimated cost
- Based on above prepare a **concept plan** for approval

Priority Areas:

- Achieve high standard of housing and upkeep
- Planned breeding of endangered species (off exhibit)
- Develop expertise on health care based on suitability of climatic condition
- Thematic display in nature immersing exhibits
- Assessment of carrying capacity of visitors
- Planning smooth visitor circulation
- Proper signage/interpretation
- Waste disposal system (garbage and liquid waste)
- Public facilities and civic amenities
- Management of natural disasters and contingencies

Before drafting the master plan it is of utmost importance and crucial to set goal for the zoo, by the end of the plan period and planning shall follow keeping that goal in mind



- What will be the theme
 - Eco system approach (Nilgiris, desert & wetland , riverine, high altitude etc)
 - Zoo/bio-geographic approach (region, country or continent)
 - Taxonomic approach (family, class or order)
 - Behavioral approach (nocturnal, aquatic, burrowing arboreal etc)
 - Any other type of approach like mythological etc
 - Paranoid disposition etc (mixture of all the above)
- Conservation breeding centre
- Amusement park
- Safari Park
- Nature Education centre etc.

MASTER PLAN

Part – I – Existing Situation

- Location and Approach
- Topography
- Vegetation
- Legal Status
- History of Zoo or Site
- Water & Power Source
- Existing Structures & facilities
- Garbage disposal
- Visitation
- Facilities in different sections and their management
- Visitor amenities
- Visitor education and research
- Landscaping
- Any other aspects needing highlighting

PART - II – PLANNING

- Master Layout Plan
- Animal Collection Plan (this is most important as the entire planning process shall be dependent on this)
- Proposed Development – Unit wise:
 - Administrative Pattern



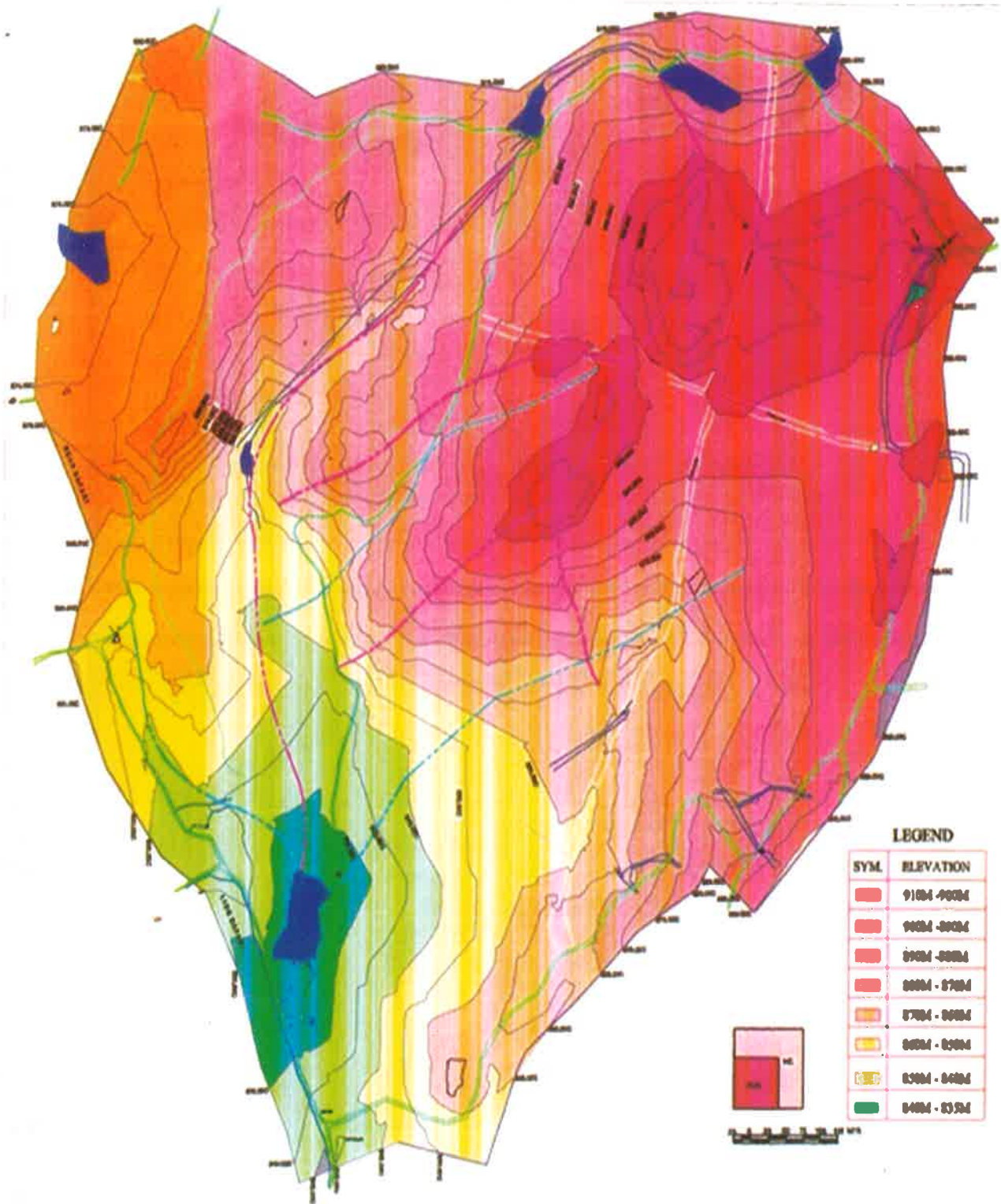
- Animal Section
- Veterinary Section
- Lawns & Gardens
- Internal Roads
- Stores
- Maintenance Section
- Revenue Section
- Research
- Education
- Tourist Amenities
- Water Supply
- Sanitation including disposal of Solid & Liquid Waste
- Power Supply
- Other Sections
- Personnel planning
- Contingency plan
- Disaster management
- E-governance
- Any other aspect peculiar to the zoo

MASTER LAYOUT PLAN

- Scale-1:1,000 to 1:5,000
- Contour interval-1m to 5m. as per topography
- Show features (water bodies, forest patches, precipices, structures and ruins, rocks, visitor circulation, amenities, drainage, water and power supply lines, solid and liquid waste disposal, entrance, approach, colony, parking lot, administrative building , veterinary hospital, feed store carcass disposal area, surrounding area and topography etc.)
- Layout plan should show clearly in the following manner:
- Existing enclosures to be retained – Black
- Existing enclosures to be modified – Green
- Existing enclosures to be demolished and redone – Red
- New enclosures to be constructed – Blue
- Structures other than enclosures can also be given similar colours when retained modified demolished or new.
- Power lines, sewerage lines, visitor circulation, service paths and water supply lines should be clearly shown in the layout plan



TOPOGRAPHIC ANALYSIS





MASTER LAYOUT PLAN



PROJECT
**PROPOSED NIGHT SAFARI AT BANNERGHATTA,
 BANGALURU, KARNATAKA**
 OWNER
 JUNGLE JIGGIES & RESORTS, P.O. BANGALURU

DRAWN BY
MASTER PLAN
 DRAWING NO.
LS 101
 SCALE
 1:300
 DATE
 02.02.2008





COLLECTION PLAN

- Collection Plan, is a plan, listing animals and their numbers, which the zoo intend to procure and house in/ remove from the zoo based on carrying capacity, which will be determined by availability of enclosure space, capability of zoo personnel (keepers) to handle them and ability of the zoo to support the number with ease etc. While doing so, care should be taken to see that smaller number of species in large social groups are planned to be kept.
- Priority should be given to the locally occurring species and those, which are from similar climatic conditions. This collection plan should keep in mind the space, facility and expertise with the zoo, and species which can be procured from other zoos of the country or abroad without difficulty and can be maintained by the zoo without difficulty.
- The collection plan should be in tabular form indicating present number of each species with sex, number proposed to be kept with sex and animals proposed to be procured.
- There should be arrangement of review functioning and course correction of the master plan, if required periodically, may be every 5 years.



DESIGN FOR EDUCATION

PRESENTED BY –



MONIKA FIBY

- MASTER OF LANDSCAPE ARCHITECTURE
- FOUNDER OF THE ZOOLEX ZOO DESIGN ORGANIZATION

INFORMAL LEARNING

Informal learning is voluntary, exploratory, often unconscious and driven by curiosity.

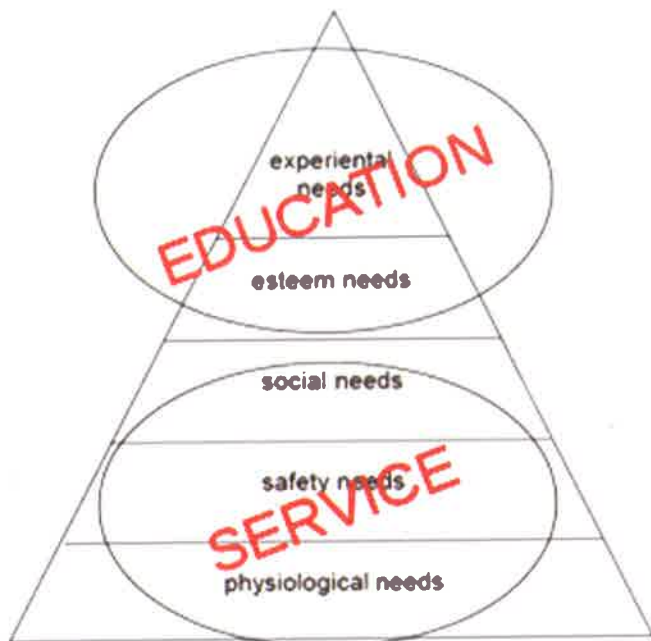
It relies on the memorable delivery of messages and ideally is conducive to empathy, enthusiasm, competence and new behaviours.

Sequence of informal learning	Design tasks
perception	create educational attractions (scene, encounter, demonstration with a message)
attention	reduce distraction, increase motivation
emotional experience (delight, surprise, bonding)	create a consistent message (context fits content)
memory	create reinforcing experiences (other media, similar attractions, new attractions for repeat visits)



Zoo Visitors' Needs

Hierarchy of needs after Maslow



Zoo design answers

5 contact with animals, plants, water, people

4 programmes and interaction

3 sites to play, relax, communicate

2 support for orientation (signs, guides), usability of paths at all weathers and for all audiences, including handicapped and those with strollers

1 restaurants, toilets, seating, temperature control, light control, weather protection

TIME ALLOCATION OF VISITORS

Example for a stay of about 2 hours and about 2 km length of pathway



Source: Evaluating Zoo Design - The Importance of Visitor Studies, 1992



INFLUENTIAL FACTORS

- marketing and visitor expectations
- culture and time budget (free time planning)
- experience quality and distribution
- comfort of moving around
- service quality, comfort of resting places
- variance between concentration and relaxation
- variance between active and passive entertainment



Menagerie



Zoo



Nature Park



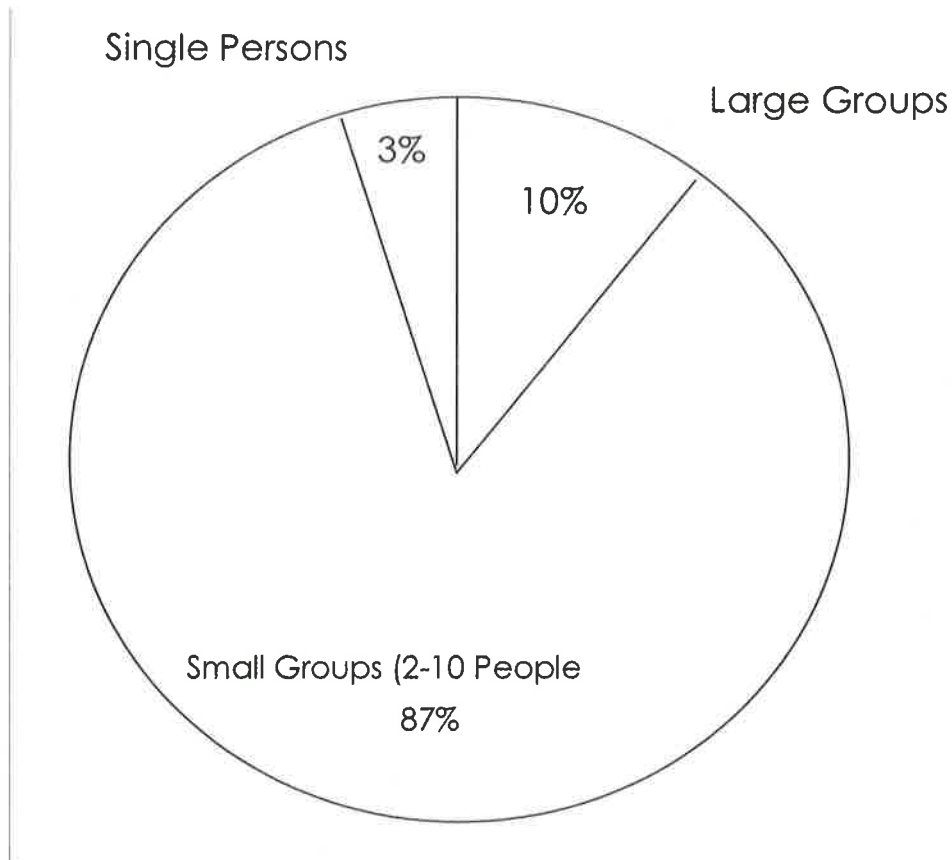
Safari



Amusement Park



GROUP COMPOSITION OF VISITORS



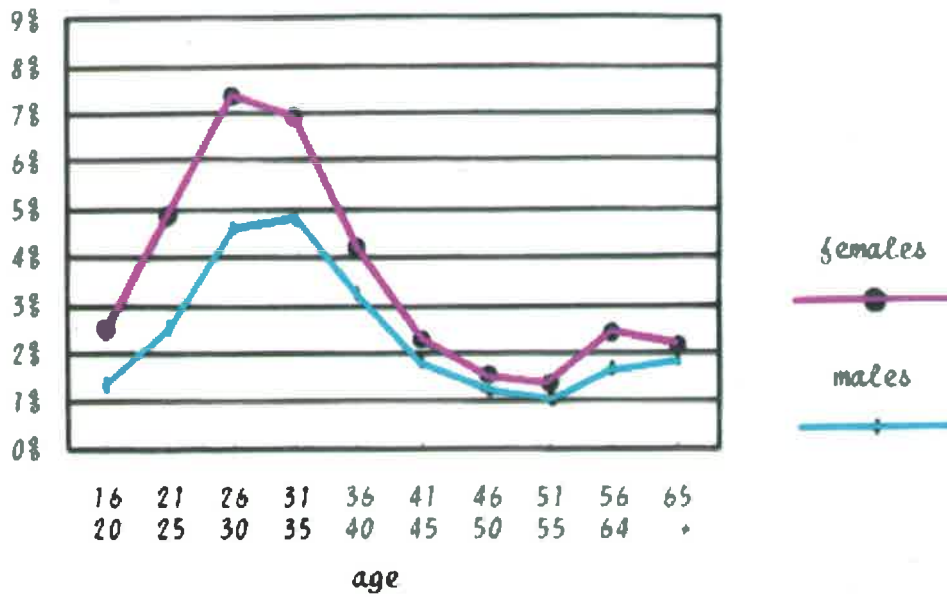
Typical distribution from results of a count at the Salzburg Zoo, 1993:

Single Persons		2,2 %
Small Group Members, thereof:		87,2 %
Visitors in pairs	12,8 %	
Visitors with family	48,1 %	
Visitors in other small groups	26,3 %	
Visitors in large groups		10,6 %

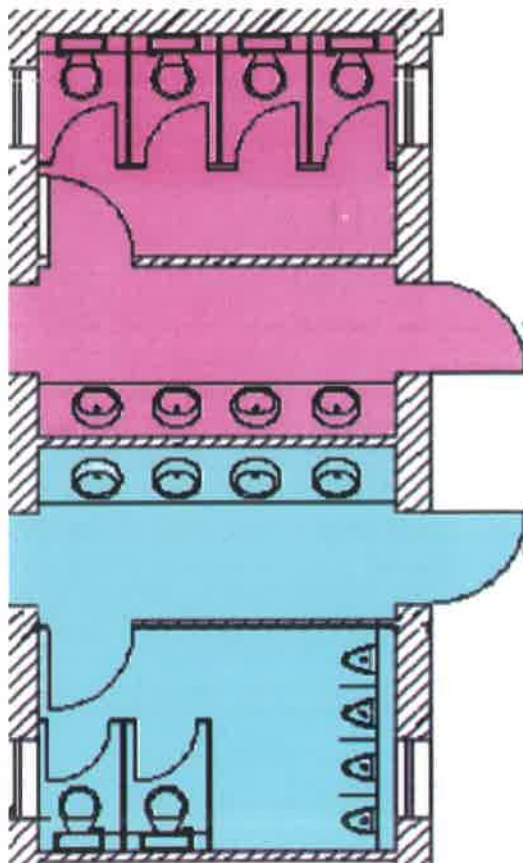
Source: Evaluating Zoo Design - The Importance of Visitor Studies, 1992



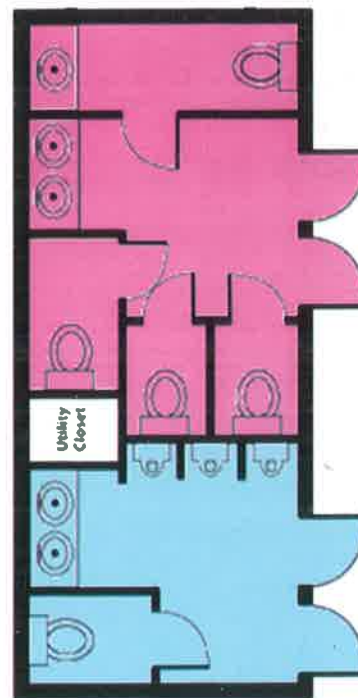
GENDER COMPOSITION OF VISITORS



spaces for 4 women and 6 men



spaces for 4 women and 4 men





OBSERVATION TIMES

Average Viewing Times in Museums and Zoos:

Static Objects in Museums	15 – 40 sec.
Zoo Exhibits	40 – 90 sec.
Interactive Elements	90 – 120 sec.

Average Viewing Times of Various Animal Species in Seconds:

Animal Species	When Inactive	When Active
Hippo	51,3	109,2
Tiger	31,5	88,0
Grizzly Bear	26,6	77,0
Elephant	45,2	76,4
Boa	21,8	73,6
Otter	35,5	63,0
Gibbon	14,8	61,2
Rhino	40,1	60,3
Puma	30,2	55,9
Polar Bear	33,3	55,1
Python	27,4	53,7
Kudu	10,5	41,4
Leopard	27,6	40,2
Cobra	15,1	28,7
Camel	13,4	28,0
Tapir	16,9	26,0

Source: Evaluating Zoo Design - The Importance of Visitor Studies, 1992



VISITOR CIRCULATION SYSTEM

Primary Pathways:

The main or primary path is usually a circuit that provides access to most facilities. It has a hard surface for vehicles and is wide enough for large groups to pass. The layout of the path should avoid long straight sections and should provide variance through planted areas and landforms. All major visitor service facilities are found along the primary path, including maps, toilets, seating places, and eating and shopping facilities. Wide paths should not pass by small exhibits but lead to secluded observation areas.

Secondary Pathways:

The next level of pathways is for the experience of animal exhibits. In small parks they fulfill the purpose of the primary paths.

They are also hard-surfaced for vehicles, but narrower than the main path and not leading to main visitor facilities. On secondary paths, visitors find seating and viewpoints designed for small groups and a peaceful setting for focusing on the animals.

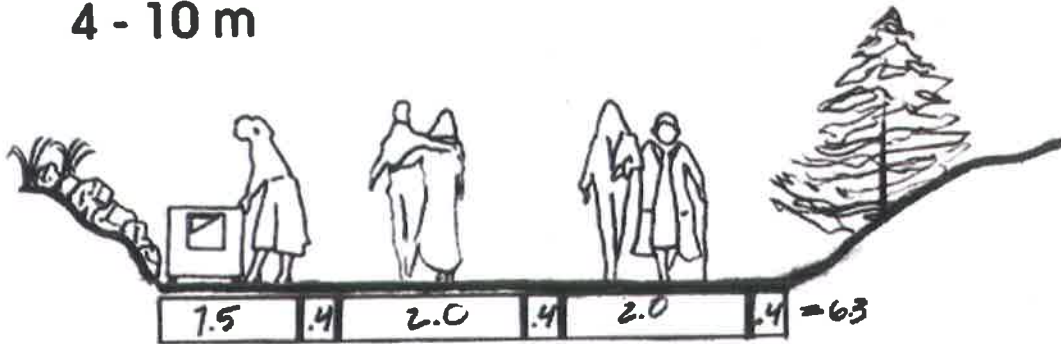
Tertiary Pathways:

Tertiary paths provide nature experiences and immersion.

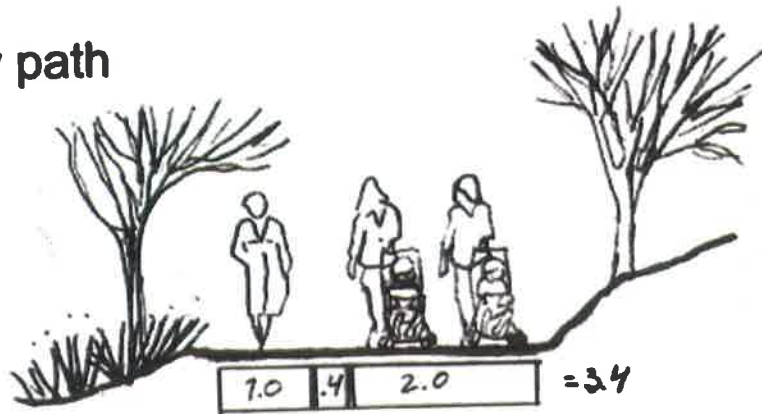
The minor circulation system is paths that are integrated with the landscape, so small in some areas that visitors can only walk behind one another. Their surface is soft and permeable, but they must be capable of withstanding regular use. There should be little furniture, except educational signage and interactive.



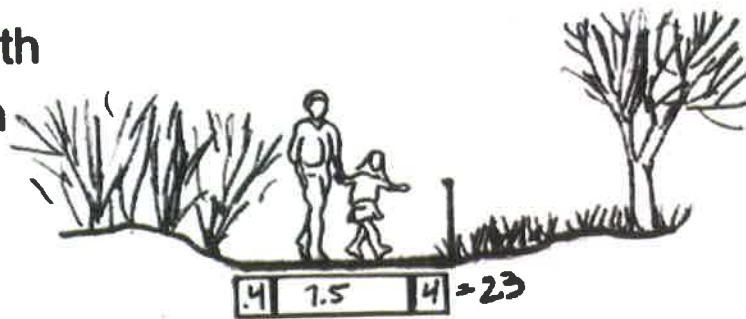
Primary path 4 - 10 m



Secondary path 2.5 - 4 m



Tertiary path 1.2 - 2.5 m



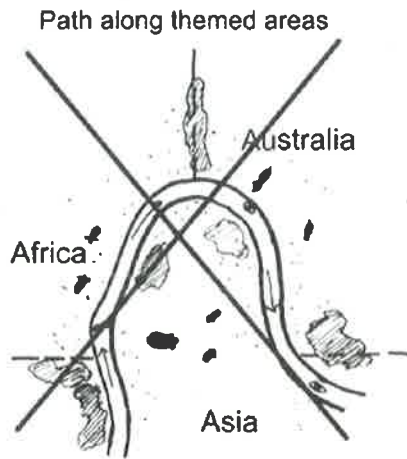
Graphic: Monika Fiby, Carlyn Worstell, 2003

ZooLex Workshop

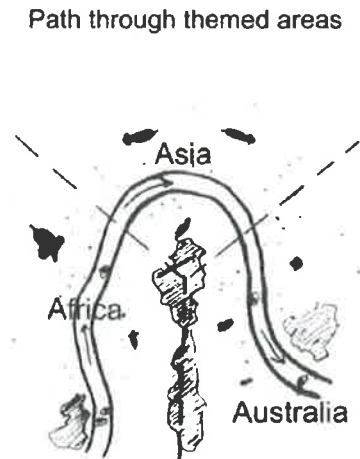


ANIMAL VIEWING

Immersion into themes

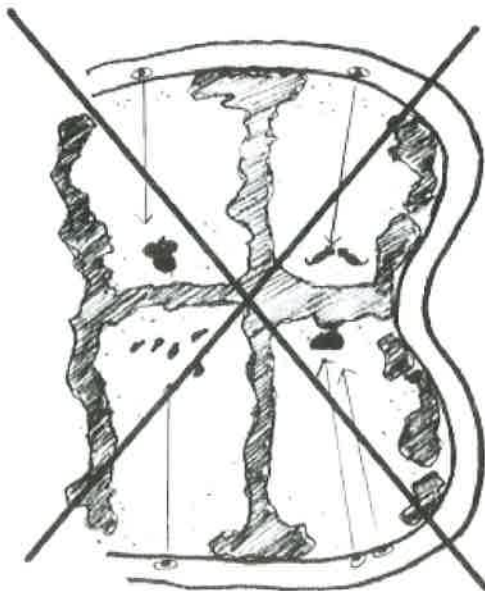


Graphic: Monika Fiby, Carlyn Worstell, 2003

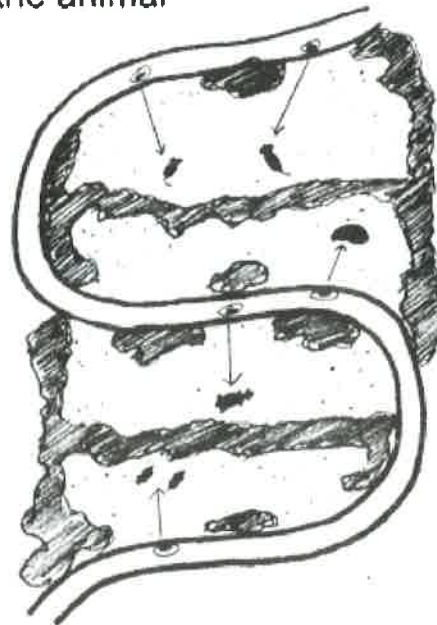


ZooLex Workshop

Being close to the animal



Graphic: Monika Fiby, Carlyn Worstell, 2003

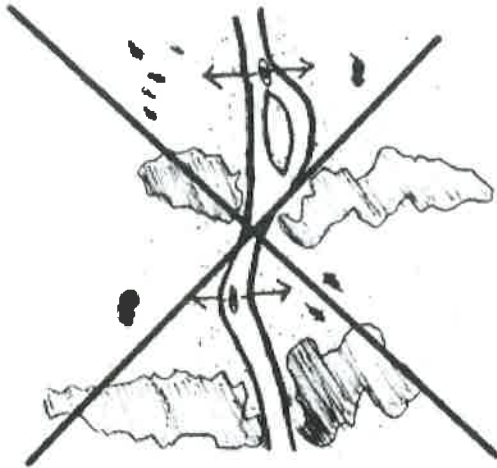


ZooLex Workshop



Landscaping guides movement and views

Competing attractions



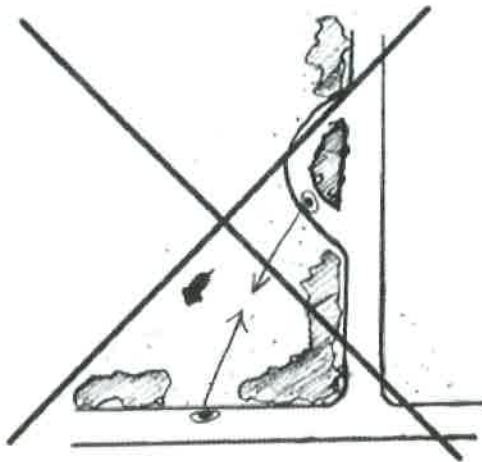
Graphic: Monika Fiby, Carlyn Worstell, 2003

Guided attention



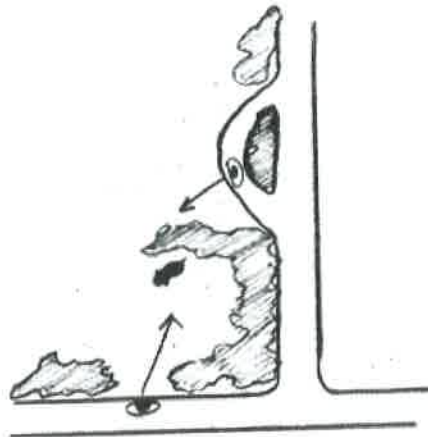
ZooLex Workshop

Observing people (Cross viewing)



Graphic: Monika Fiby, Carlyn Worstell, 2003

Observing animals

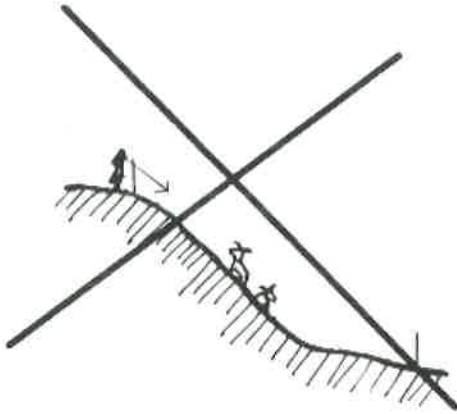


ZooLex Workshop



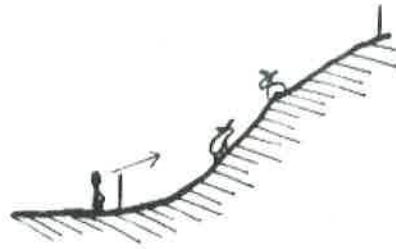
Using slopes

Fences in good view
Short perspective
Looking down on animals



Graphic: Monika Fiby, Carlyn Worstell, 2003

Animals in good view
Long perspective
Looking up to animals



ZooLex Workshop

Use afternoon sun

View against sun

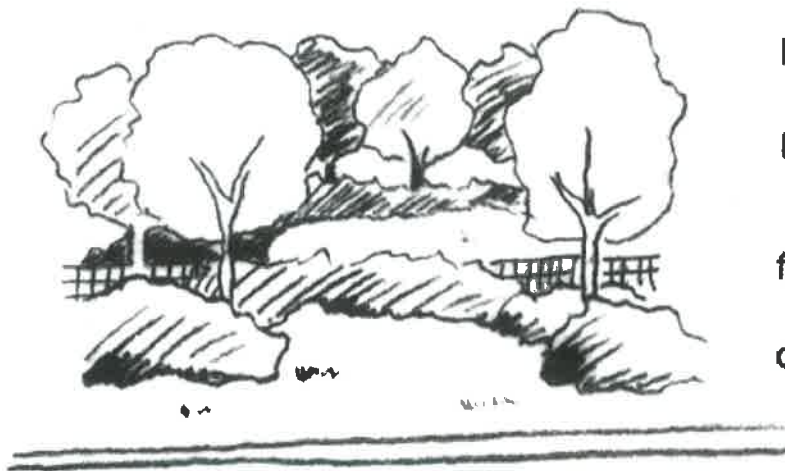


Grafik: Monika Fiby, Carlyn Worstell, 2003

View on exhibit in sun



ZooLex Workshop

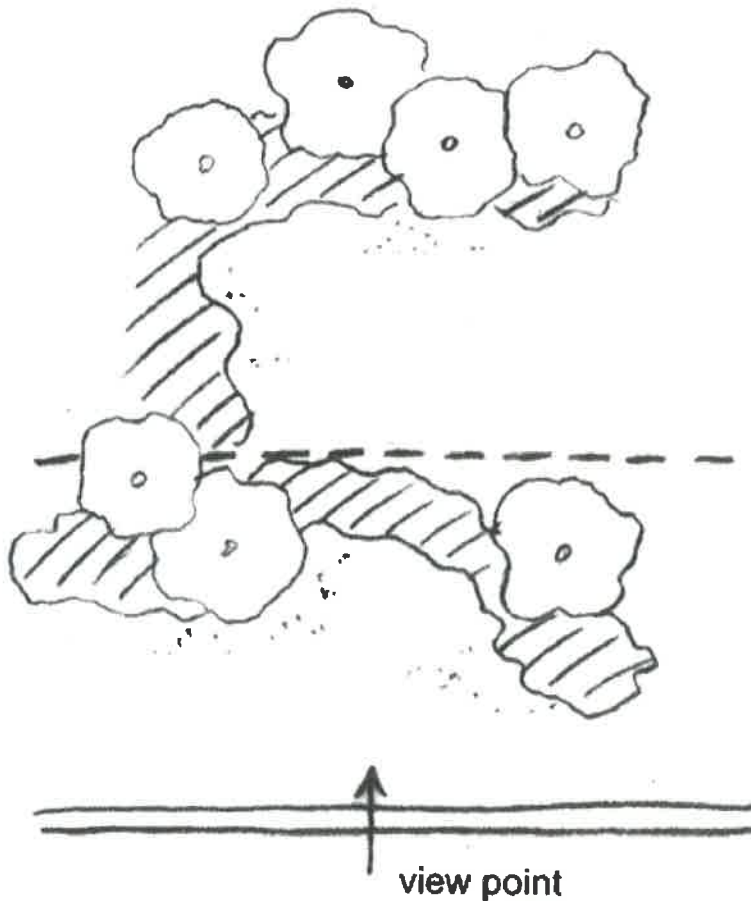


perspective view:

borrowed landscape

fence

designed landscape



plan view:

borrowed landscape

fence

designed landscape

Graphic: Monika Flby 2004



IMMERSION EXHIBITS

- **Realization**

Immersion exhibits and the allocated visitor area are replicating the natural habitat of the animal exhibited. Animals and visitors share the same environment. Visitors are immersed into the animal's habitat.

- **Potentials**

- Visitors associate animals consciously or unconsciously with their proper habitat.
- Immersion exhibits are aesthetic.
- Separation between animals and humans are inconspicuous.
- Animals can express their natural behaviours better in a complex and stimulating environment.
- Visitor feel closer to the animals and their habitat.
- Animal keepers have a good feeling regarding animals' well-being.

- **Restrictions**

- Animal security, management and health
- Costs of construction and maintenance
- Visitor security
- Visibility of animals



REMEDIAL MEASURES

1. Gradually create a bank of professionals familiar with animal behavior & zoo design requirements. Make zoo designing professionally rewarding.
2. Ensure clarity and precision of common objective amongst all concerned.
3. There should be a complete clarity across all concerned with regard to the final outcome (layout, levels, materials, colors, textures, etc.) before any activity begins at site.
4. Clarity with regard to sequence and schedule of work.
5. Site specific variations in methods and procedures should be defined prior to execution.
6. There should be periodic and regular peer reviews during designing and execution (to ensure the creation of what has been approved).
7. Presentation of material/ color/ texture board.
8. Preparation and approval of material samples and samples of walls, railings etc.
9. Regular and stringent financial management related to construction schedule for administrative control.
10. Creation of comprehensive bank of reliable vendors and suppliers of materials & fixtures required for zoo construction.
11. Appropriate and adequate clauses in the contract to allow to recover from various unattended administrative and execution contractual lapses.

REQUIREMENTS TO REALIZE THE REMEDIES

Experienced persons related with zoos are required.

Visualize, conceptualize and manage zoo construction in methodically.

Zoo construction involves:

- a) Construction methods and techniques with specifications
- b) Subjective considerations

While zoo management are involved in the entire process of zoo creation and management they are more familiar with management than construction.

Zoo construction requires a co-coordinator having an overview of animal behavior and other zoo requirements. Architects, landscape architects (who in turn manage other professionals) is a suitable option.

This combination is easier acquired by architects than zoo managers.



Immersion Exhibit

The natural habitat of an animal species is replicated. Visitors are immersed into this environment. Animals and visitors share the same environment. The perception of "safe danger" heightens experience and memory. Immersion exhibits are always naturalistic because an animal habitat is replicated. However, not all naturalistic exhibits are immersion exhibits. Small exhibits, like aquaria and terraria, are often placed in surroundings that are not reflecting the same habitat.

Artistic Exhibit

The predominant appearance of the exhibit is one of formal aesthetics. This exhibit style cannot be naturalistic.

Functional Exhibit

Exhibit elements fulfill functions such as animals' needs and animal management requirements, but the exhibit does not look naturalistic, even though elements from the animal's natural habitat may be included.

CONSIDERATIONS FROM THE PLANNER'S PERSPECTIVE

- Can animals express their natural behaviors?
- Is the exhibit safe for animals?
- Is the exhibit secure for visitors?
- Will animal keepers like the exhibit?
- Is the enclosure aesthetically pleasing?
- What do visitors consciously or unconsciously associate when seeing the exhibit?
- Can they imagine the exhibited animals' natural environment?
- What can they learn?
- How will the exhibit be managed?
- How much will design, construction and maintenance cost?



DAY - III



BROAD GUIDELINES ON PLANNING AND ARCHITECTURE OF ZOOS IN INDIA

PRESENTED BY -

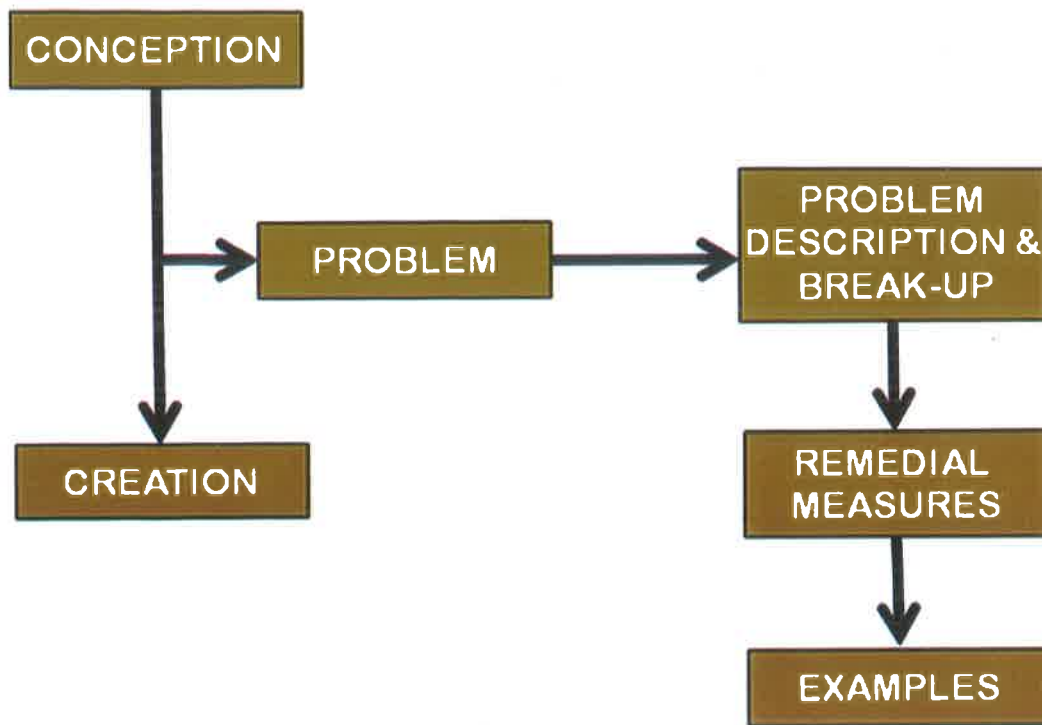


PROF. (DR.) ROMMEL MEHTA

Dept. of Landscape Architecture, School of Planning & Architecture, New Delhi



ZOO PLANNING AND ARCHITECTURE



Zoo planning and architecture is a vision and a concept. That vision has to be communicated, discussed and got executed. But this is not a simple task as zoo is not a single entity.

CATEGORIZATION OF ZOOS FOR DESIGN

Design Approach and Sequence

- Site Planning
- Layout and Design
- Construction Details

Zoo is not a single entity and therefore the design process needs to give equal weightage and consideration to all the following and the designer has to design for all of them



- Animals
- Visitors
- Enclosures
- Barriers
- Isolation

Zoo is comprehensive environmental design

In the site environment, endowed by nature, are introduced the requirements of zoo:

- Roads
- Paths
- Enclosures
- Buildings
- Services

The environment and the intrusions are maintained in a dynamic balance by maintenance and management.

Construction has to address this issue

Both creation and management involves construction.

Basic principles of zoo or other construction remain common but there are aspects which are unique to zoo construction. These include:

- a) Established, specified and coded construction techniques. There are **objective** in nature.
- b) There are features which are **subjective**; such as specific finish of a random rubble stone masonry wall.

There are design guidelines. There should be construction guidelines for zoos as well. Construction of zoos is highly environment sensitive. This sensitivity should be ensured in preparatory operations, during execution activities and post execution winding up.

- A zoo is essentially a controlled artificial environment to having various kinds of "immersion" areas for exhibits.
- This environment has to be created through construction.
- An "environment" has:
 - Objective scientific aspects
 - Subjective aspects.



- It is essential that objective aspects are not based on subjective considerations and vice versa.
- Civil work details, including estimates, are presented to CZA with no indication as to how it is intended to be related to zoo environment.
- Neither is there any indication regarding the procedure & sequence of work proposed to be followed.
- A disastrous gap between the design intent and the finished zoo is found later.
- Conception remains far removed from final result.
- Attend to considerations in selection of Architect and Landscape Architect.
- Preparation of appropriate zoo design specific contractual document is necessary.



Intelligent and innovative design solutions are needed to integrate construction aspects with seamlessly with the visual considerations. In these pictures the drainage system an eyesore has been integrated seamlessly with the surroundings.



REMEDIAL MEASURES

1. Gradually create a bank of professionals familiar with animal behavior & zoo design requirements. Make zoo designing professionally rewarding.
2. Ensure clarity and precision of common objective amongst all concerned.
3. There should be a complete clarity across all concerned with regard to the final outcome (layout, levels, materials, colors, textures, etc.) before any activity begins at site.
4. Clarity with regard to sequence and schedule of work.
5. Site specific variations in methods and procedures should be defined prior to execution.
6. There should be periodic and regular peer reviews during designing and execution (to ensure the creation of what has been approved).
7. Presentation of material/ color/ texture board.
8. Preparation and approval of material samples and samples of walls, railings etc.
9. Regular and stringent financial management related to construction schedule for administrative control.
10. Creation of comprehensive bank of reliable vendors and suppliers of materials & fixtures required for zoo construction.
11. Appropriate and adequate clauses in the contract to allow to recover from various unattended administrative and execution contractual lapses.

REQUIREMENTS TO REALIZE THE REMEDIES

Experienced persons related with zoos are required.

Visualize, conceptualize and manage zoo construction in methodically.

Zoo construction involves:

- a) Construction methods and techniques with specifications
- b) Subjective considerations

While zoo management are involved in the entire process of zoo creation and management they are more familiar with management than construction.

Zoo construction requires a co-coordinator having an overview of animal behavior and other zoo requirements. Architects, landscape architects (who in turn manage other professionals) is a suitable option.

This combination is easier acquired by architects than zoo managers.



With such numerous variables of climate, topography, forest types, geological & hydrological regimes, animals, birds are involved and add to it the varied backgrounds, experiences, and knowledge levels, vested interests of all concerned with the zoo design along with local social and political scenarios.

Zoos generally have large areas and dimensions

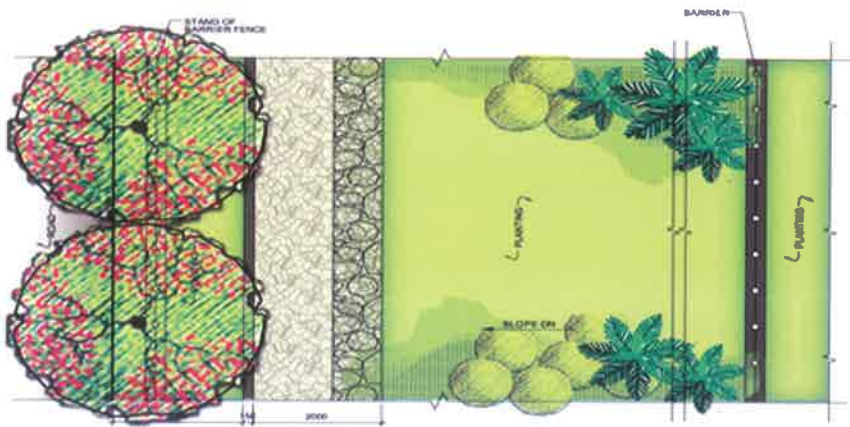
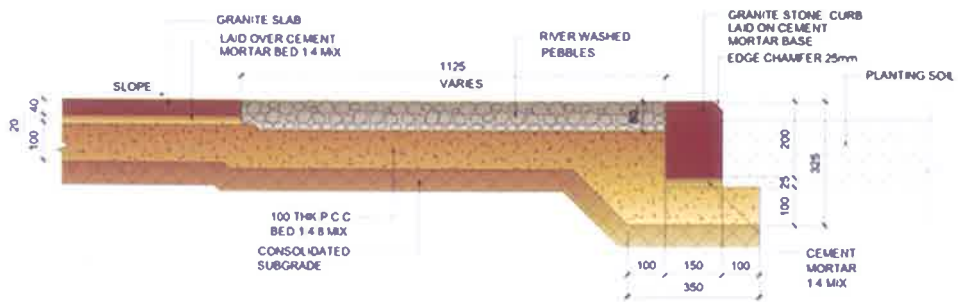
Therefore, it requires "landscape planning" as well as landscape/ architectural design.

Landscape planning incorporates macro-environment of land used and planning activity dealing with landscape features, processes and systems.

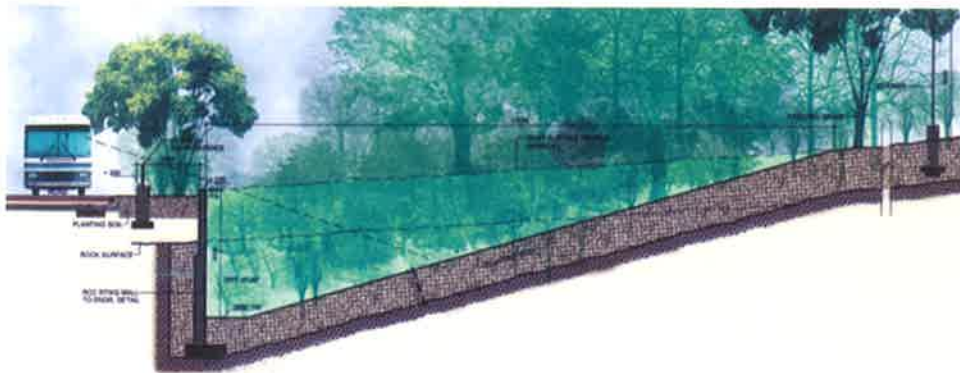
Landscape and architectural design will mean design detail of smaller specific areas such as enclosures, barriers, public utilities, shelters, walls, steps etc.

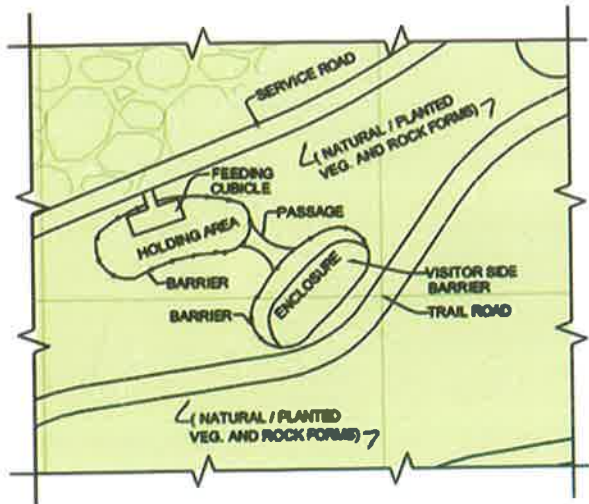
It has been observed that while the intention and visualization may be apparent, but the necessary drawings and specifications stop far short of what is required by various contractors to execute the work to achieve the desired result.

The consequence is that this gap is covered by an assumption to follow what is existing and previous examples. This has retarded innovation and use of latest materials, methods and materials.

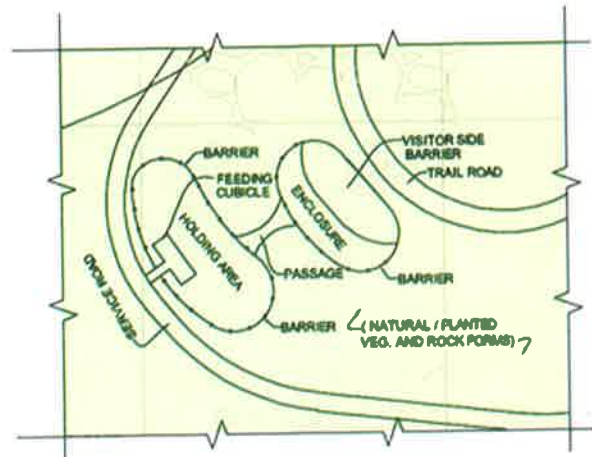


A1 DRY MOAT BARRIER - PLAN & ELEVATION (EMU)
SCALE 1:50

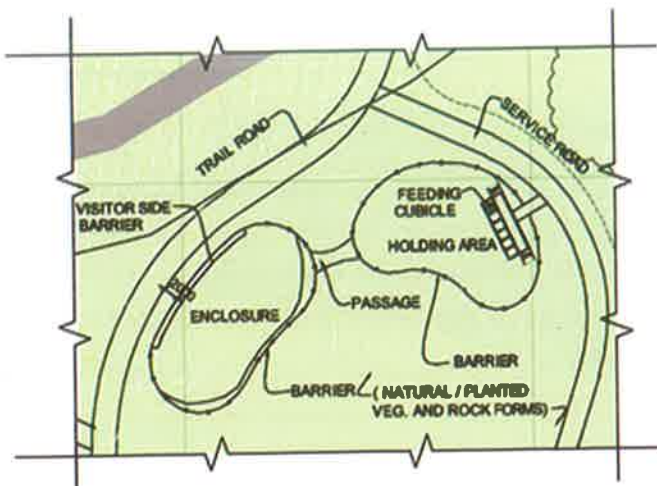




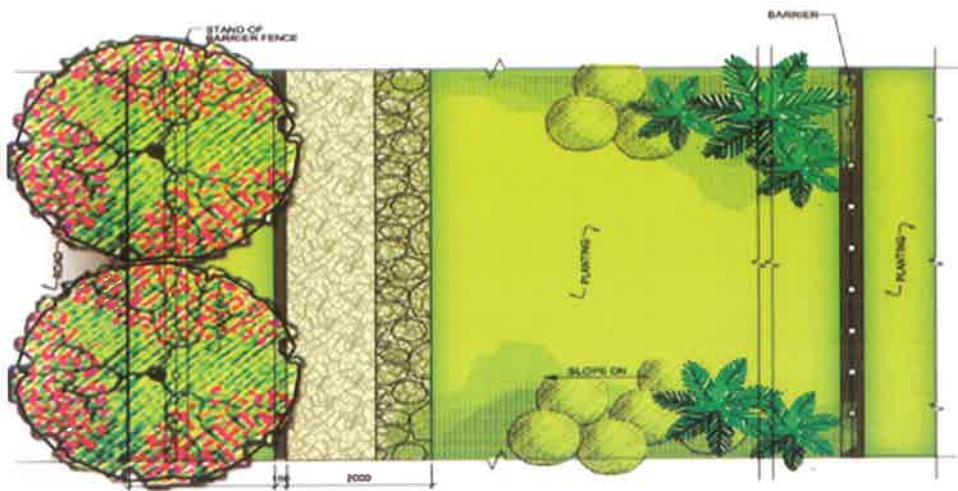
C1 BARKING DEER ENCLOSURE & HOLDING AREA
SCALE 1:1500



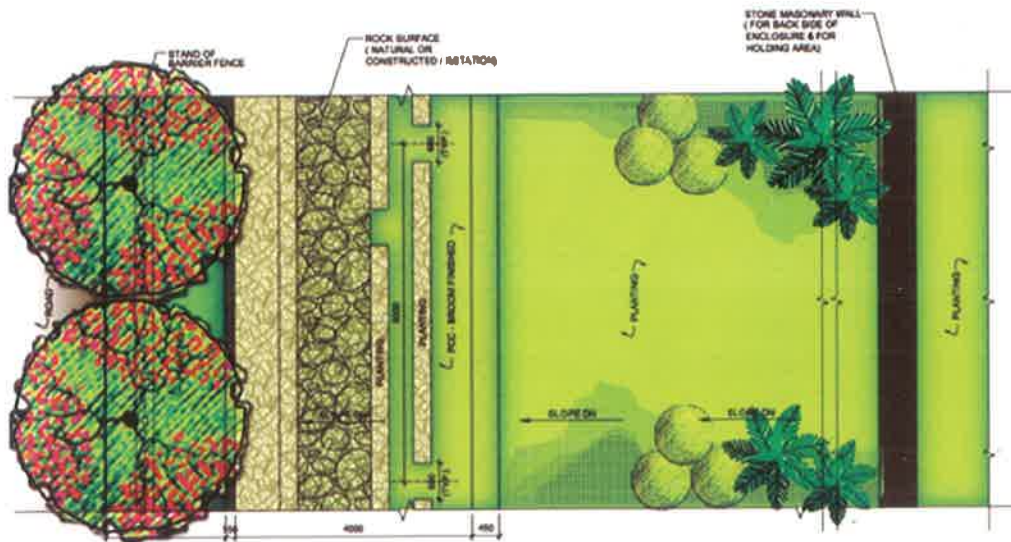
C2 SAMBHAR ENCLOSURE & HOLDING AREA
SCALE 1:1500



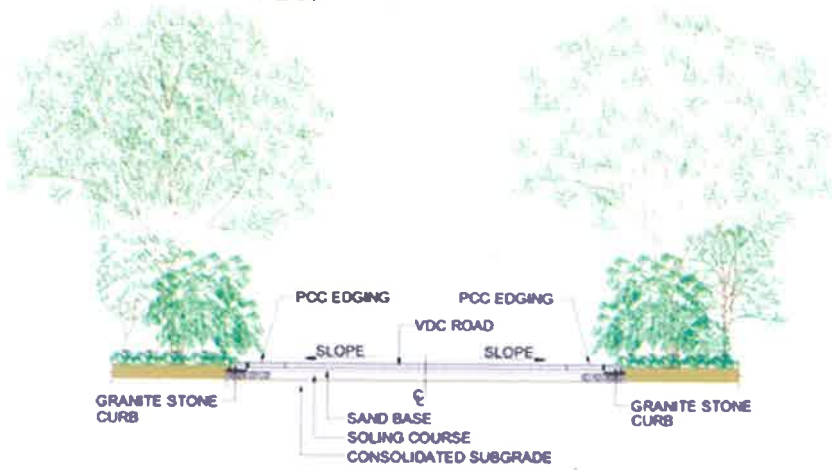
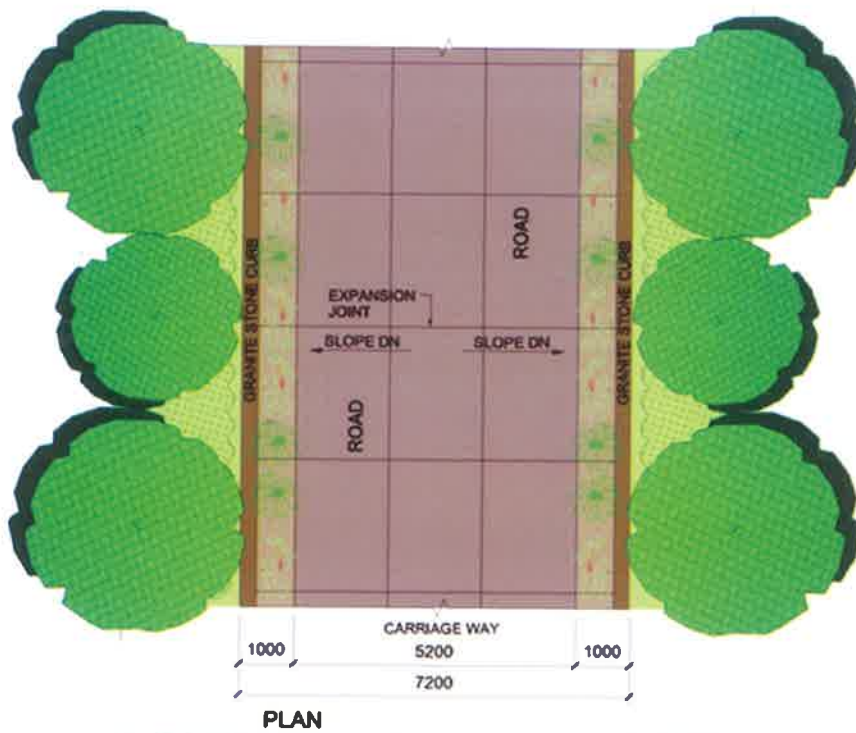
A3 TIGER ENCLOSURE & HOLDING AREA
SCALE 1:1500



A1 DRY MOAT BARRIER - PLAN & ELEVATION (EMU)
SCALE 1:50



A1 DRY MOAT BARRIER - PLAN & ELEVATION (HIMALAYAN BLACK BEAR & SLOTH BEAR)
SCALE 1:50



VDC ROAD TYPE -3



BIODIVERSITY AND LANDSCAPE ARCHITECTURE: ROLE PLAYED IN ZOO DESIGNING

PRESENTED BY-



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DEFINITION:

Convention on biological diversity (cbd) held at Brazil in June 1992, at the United Nations conference on environment and development, "earth summit",

Defines biological diversity as

"The variability among living Organisms from all sources including, inter alia, Terrestrial, marine and other aquatic ecosystems And all the ecological complexes of which they Are part; this includes diversity within species, between species and of ecosystems."

By March 1994, a total of 167 countries, including India had signed the Convention, and 53 had formally ratified it, signifying their readiness to abide by its provisions.

INDIA'S INITIATIVES:

The National Biodiversity Strategy and Action Plan (NBSAP) was initiated in India by the Ministry of Environment and Forests in January 2000. Emphasizes on decentralized state level planning, and the use of interdisciplinary working groups to involve all sectors concerned with biodiversity conservation.

The Biological Diversity Act 2002, received the President's assent on 5th February 2003. Chapter IX of the Act, emphasizes insitu and exsitu conservation of biological resources. Integration of the Conservation strategies with relevant sectoral or cross - sectoral programmes has also been suggested.

Being signatory to the Biodiversity Convention, and legally as per the Biological Diversity Act 2002, we have taken upon ourselves the responsibility to safeguard the country's and also the global biodiversity.

Survey, documentation, research, action plans, implementation and monitoring of plans, projects to ensure biodiversity conservation are some of the ways by which we intend to fulfill this commitment.

Zoos are examples of biodiversity conservation in ex-situ situations



URBAN BIODIVERSITY:

In many parts of the world, a majority of the population live in urban areas. This is the case in a growing number of developing countries as well.

- At a regional level; there is greater biodiversity in developing countries, than in the developed countries.
- Statistics show that within the developed areas of cities in the developed countries the percentage of open spaces is much higher than those in developing countries.
- Hence, it becomes all the more necessary for the developing countries to protect their urban biodiversity.

Plan of action on sub national governments, cities and other local authorities for biodiversity (2011-2020):

- Local biodiversity strategies and action plans (LBSApS)
- Parties to the Convention on Biological Diversity should, as appropriate, seek to engage their subnational Governments, cities and other local authorities, to achieve the objectives of the Convention and the implementation of the Strategic Plan of the Convention for the period 2011-2020, in line with their (NBSAPs) and other relevant governance arrangements established by their national Governments.
 - Capacity-building programmes based on best practices,
 - Innovative financial mechanisms to support their implementation
 - Increase synergies between the various levels of government
 - Awareness campaigns on the importance of biodiversity and ecosystem services
 - Monitoring and evaluation systems for subnational governments
 - Set benchmarks for local biodiversity management.



III) Plantae	IV) Fungi	V) Animalia
<ul style="list-style-type: none">• Non-vascular plants -eg. Mosses	<ul style="list-style-type: none">• Zygomycetes -eg. Moulds	<ul style="list-style-type: none">• Multicellular organisms - eg. hydra, worms, snails
<ul style="list-style-type: none">• Vascular plants -eg. Ferns	<ul style="list-style-type: none">Ascomycetes -eg. Yeasts	<ul style="list-style-type: none">Invertebrates - insects, centipedes
<ul style="list-style-type: none">• Gymnosperms -non-flowering plants• Angiosperms -flowering plants	<ul style="list-style-type: none">• Basidiomycetes -eg. Mushrooms	<ul style="list-style-type: none">• Vertebrates -fishes, amphibians - reptiles,birds,, -mammals

CLASSIFICATION OF SPECIES AND ECOSYSTEMS:

In practice, Species Diversity is central to the evaluation of diversity at other levels and is a constant point of reference in biodiversity studies.

Five Kingdom Classifications:

I) Prokaryotae

Archaeobacteria and Eubacteria

Blue-green bacteria

II) Protocista

Single-celled eukaryotes

Multicellular algae-red, brown and green algae

CLASSIFICATION OF SPECIES AND ECOSYSTEMS:

Ecosystem: A community of organisms together with the physical environment where they live.

Landscape: Landscapes have been found to be very useful to generate scientific basis and understanding for biodiversity characterization. "Landscape" here means the landforms of a region in aggregate or to the land surface and its habitats at scales of hectares to many square kilometers.

Biome: Collective name for communities with the same appearance living in similar environments but in different parts of the world.

Biosphere: It is that portion of the earth, above and below the surface, where life exists. The above spatial classification can be depicted below



Table 1.1: Habitat Scale

Scale	Approximate area (sq km)	Landscape unit	Scale level
Microhabitat (small)	1-10000	Leaves, soil, walls, poles, etc. (small systems)	ECOSYSTEM
Meso-habitat (medium)	100-10000000 10-1000000000000 100-10000000-100000000 1000-100000000-1000000000	Ponds, woodlands, agricultural areas	LANDSCAPE
Macrohabitat (large)	10000-100000000 100000-1000000000	Regions, districts, states	BIOME
Megahabitat (very large)	1000000000	Continents	BIOSPHERE

Source: Higgs, John, Richard. *Environmental Design: An Introduction to Landscape Architecture*. Routledge, 1998, pg 11

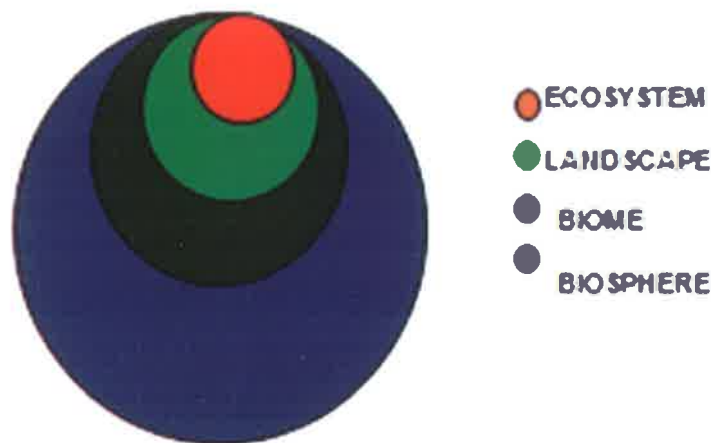


Fig: Hierarchical Depiction – Landscape level

Table 1.2: Levels of Biodiversity

Ecological diversity	Organismal diversity	Genetic diversity	Cultural diversity
Biomes	Kingdoms	Populations	Human interactions at all levels
Bioregions	Phyla	Individuals	
Landscapes	Orders	Chromosomes	
Ecosystems	Families	Genes	
Habitats	Genera	Nucleotides	
Niches	Species		
Populations	Subspecies		
	Populations		

Source: Global Biodiversity Assessment, Cambridge University Press, 1999, page 10



DIVERSITY AND STABILITY:

Current consensus is that greater diversity does lead to greater stability, for three general reasons:

Insurance Effect: Different species do better under different conditions. When perturbations do occur, it's more likely that some of the species present will be able to do well, and these species will protect the community as a whole.

Averaging Effect: Stability is measured as variability relative to community abundance. As diversity increases, the value of the variability will naturally decrease.

Negative Covariance Effect: Since species are competing for resources such as space and food, any gains that one species makes will be to some extent at the expense of the other. The result is that disturbances aren't as detrimental to the entire system as they could be, as the losses in one species are offset by the gains of another.

Focal Species: The generic term focal species has been proposed to describe a multi-species indicator or umbrella approach to protecting biological diversity at broad spatial scales. Three distinct sets of species that are sensitive to landscape change: area-or habitat-limited species, movement-limited species, and management-limited species. For overall biodiversity protection, the task is to manage the landscape to meet the needs of the most sensitive species.

<p>URBAN OPEN/ GREEN SPACES</p>	<p>Regulation Functions</p>	<ul style="list-style-type: none"> • Regulates the chemical composition of atmosphere and purifies the local air. • Controls the runoff and flooding. • Regulates the hydrologic cycles. • Supports the biological diversity in the city. • Prevents soil erosion and sedimentation. • Regulates the local and global climate • Provides food and raw materials
	<p>Carrier Functions</p>	<ul style="list-style-type: none"> • Conserves the energy in the city through controlling the micro climatic variations • Provides recreation and tourism. • Integrates urban man to the nature • Produces oxygen • Recharges the ground water tables • Provides medical resources. • Produces raw materials for some of the human activity.
	<p>Production Functions</p>	<ul style="list-style-type: none"> • Aesthetic information. • Spiritual and religious information • Cultural and artistic inspiration. • Scientific and educational information source.²⁴
	<p>Information Functions</p>	



An attempt to view human settlements as ecosystems identifies the critical role played by the natural resource base to sustain the human population.

It is also being increasingly observed that the Biodiversity Status of these areas is an indicator of the quality of the ecological infrastructure and therefore an indicator for sustainability.

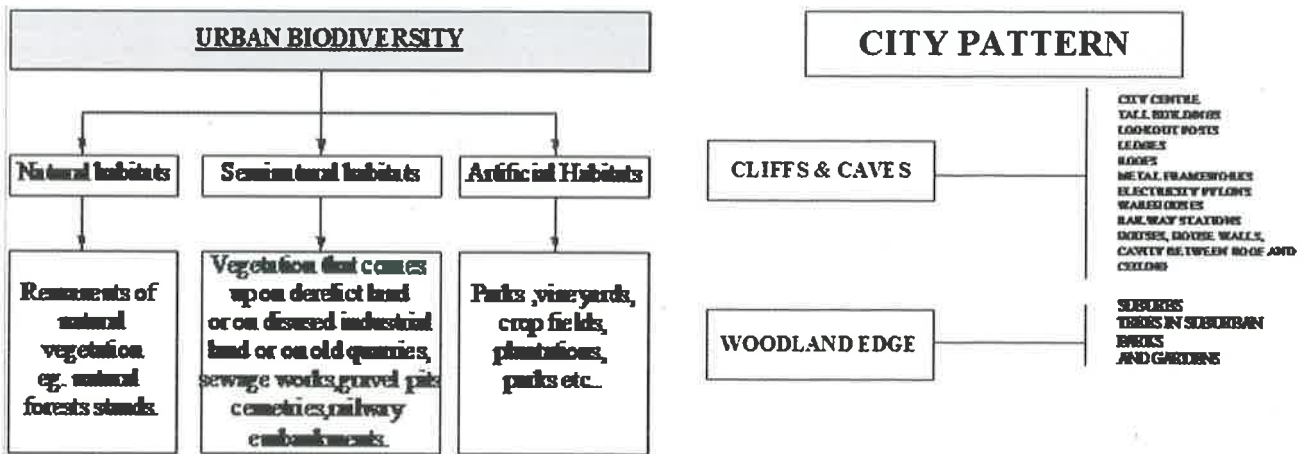
Resolution 15/11, adopted by the United Nations Commission on Human Settlements at its fifteenth session (Nairobi, 25 April to 1st May 1995), identifies the key measures necessary for the successful implementation of the concept of sustainable development within the context of human settlements.

Promotion of land-use planning, taking into account the density factor in a way which allows adequate social services and sustainable infrastructure.

Compilation of **"national inventories of land and other ecological resources and formulation of long-term spatial strategies to guide land resources development."**

Urban biodiversity i can be categorized as natural, semi natural and artificial habitats

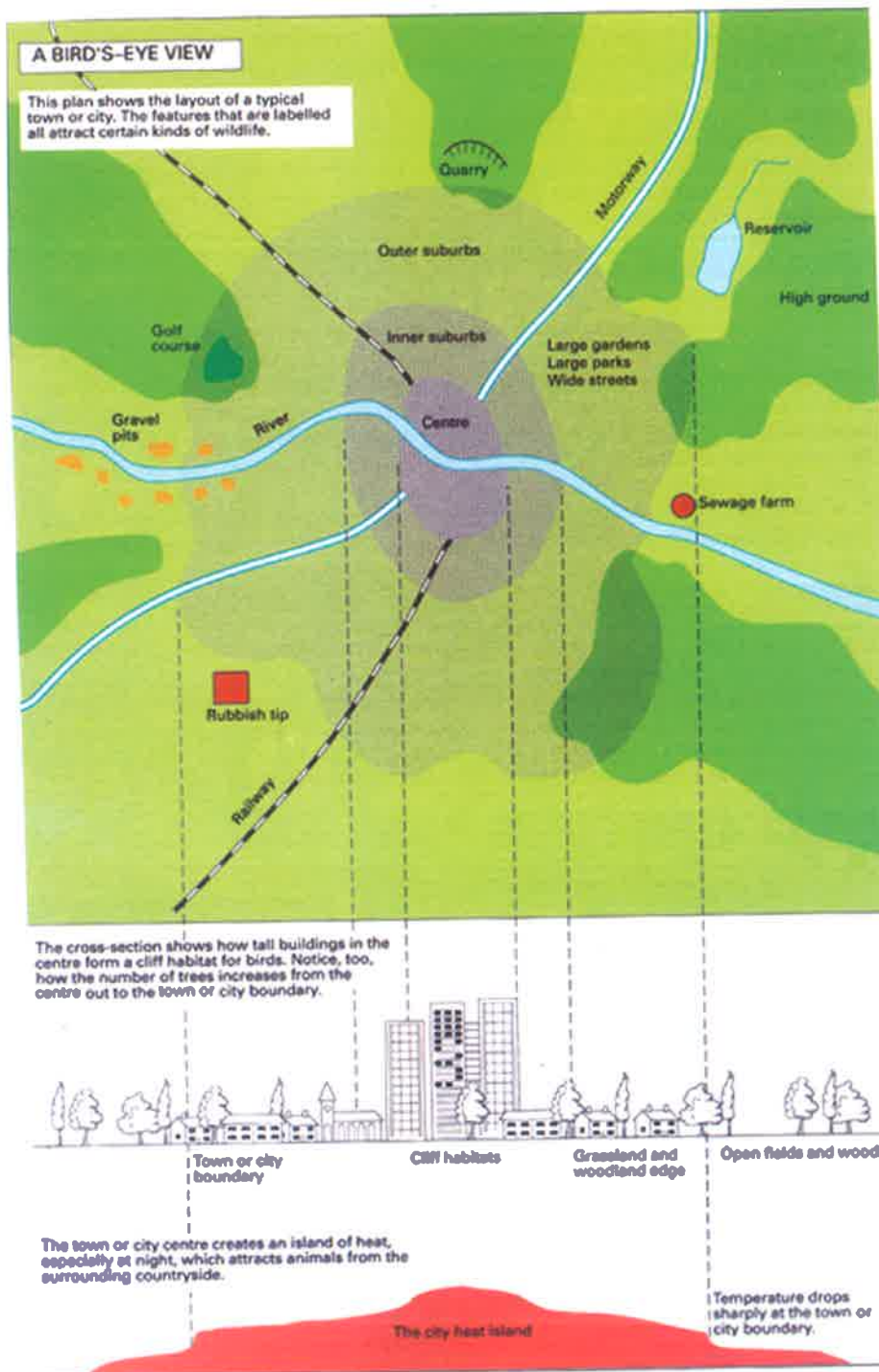
The city pattern puts forth a variety of areas for the flora and fauna to reside and grow . Organisms have chosen areas to live as per their natural preferences-either cliffs or caves or woodland edge.



Ecologists often have treated "urban" as a separate type of land-cover, akin to "agriculture" or "grassland". In fact, "urban" is an endpoint on a continuum of settlement intensity – a gradient that extends from sparsely populated rural areas to large cities.



Advantage of the gradient approach, as opposed to binary comparisons (e.g. urban vs. rural or suburban vs. wild land), lies in its potential for identifying threshold or breakpoints where human impacts cause marked changes in biotic response – in measures of human density, patterns of settlement, or distance from developed areas.





BIODIVERSITY OF DELHI:

NCT Delhi lies in the Semi- Arid Biogeographic zone; the natural vegetation of this zone consists primarily of Tropical Thorn Forests.

Delhi stretches between 28°12'N - 28°53'N and 76°50'E - 77°23'E latitudes and longitudes at an average Altitude of 216m above m.s.l., and its geographical area is 1483 sq. kms. (1,48,300 ha).

Infact, Delhi seems to lie as a gateway between Thar Desert and Indo-Gangetic plains and the Aravalli Range and Himalayas Delhi is also situated on the water divide (i.e. the Aravallis)dividing the two mighty river systems- the Ganga draining into the Bay of Bengal and – the Indus falling in the Arabian Sea.

The city has a well documented history of earlier settlements. It represents the complexities of large urban settlements and has been subjected to two planning exercises, with the third underway.

Delhi is unique, as within its urban fabric lie examples of forest, hill and river ecosystems. Lying within the heart of Delhi urban area is the northernmost flank of the Aravallis hill system, which supports a Reserve Forest, one of the few of its kind in a city of this size in the world. The floodplains of the River Yamuna bisect the urban area.

Within the broad category of terrestrial and aquatic ecosystems the NCT presents an amalgamation of a wide variety of habitats manifested in agricultural lands, rural settlements, urban villages, and in the varied matrix of urban landuses - residential, commercial, industrial, open space, water bodies etc.

The percentage of area under open spaces within urban Delhi is 19%, (DDA estimates) which is on the higher side as compared to other metropolii. Studies across the country also indicate a concentration of a large number of birds in the city of Delhi.

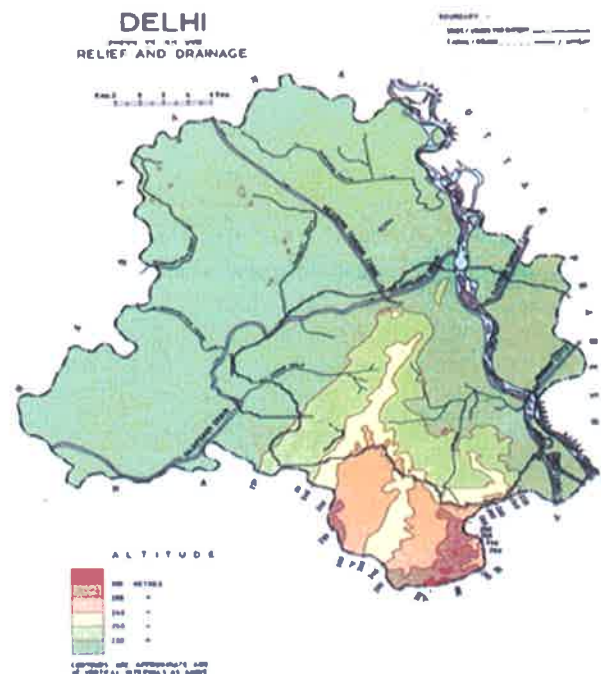




Table (i): Biodiversity of some Indian cities

S.NO.	GROUP	UNIT	PUNE	BANGALORE	DELHI
1.	Fungi	Genus	65	n.a	n.a
2.	Herbs	Species	600	n.a	n.a
3.	Trees	Species	350	n.a	n.a
4.	Aquatic insects	Family	13	n.a	n.a
5.	Snails	Species	15	23	n.a
6.	Ants	Genus	12	73	n.a
7.	Butterflies	Species	105	130	50
8.	Fishes	Species	70	40	87
9.	Amphibians	Species	14	15	7
10.	Reptiles	Species	50	37	25
11.	Birds	Species	300	315	434
12.	Mammals	Species	65	40	32

Source: Gola, Prakash (Ed.) Journal of Ecological Society, Vol.13 and 14; 2000-2001; Biodiversity Profile of an Urban Area, Ecological Society, Pune, pg-9

ECOSYSTEM DIVERSITY OF DELHI:

LOWLANDS: Flat agricultural/ horticulture, grazing lands.

HILLS: Rocky outcrops with arid vegetation

FOREST ECOSYSTEMS: Dry deciduous arid forest of the Ridge.

VALLEYS: Natural storm water drains.

FRESHWATER WETLANDS: Lakes and ponds.

RIVERINE ECOSYSTEM: River and flood plains





Table 3.13 Habitat Scales for NCT Delhi

S.No.	Administrative unit / Planning unit / Ecosystem / Landuse	Description	Habitat scale
1.	NCT Delhi	Administrative unit	Meso (large)
2.	Urban Delhi	Planning unit / Administrative unit	Meso (small)
3.	Rural Delhi	Planning unit / Administrative unit	Meso (small)
4.	Lowlands	Ecosystem, mainly agricultural lands	Meso, /micro As per area
5.	Forests	Ecosystem,	- do -
6.	Valleys	Ecosystem	- do -
7.	Hills	Ecosystem	- do -
8.	Fresh water wetlands	Ecosystem	- do -
9.	Riverine	Ecosystem	- do -
10.	Planning divisions – A to H, J to P	Planning unit	Meso
11.	Residential use zone	Landuse	Micro
12.	Commercial use zone	Landuse	Micro
13.	Manufacturing zone	Landuse	Micro
14.	Public & Semi Public	Landuse	Micro
15.	Recreation	Landuse	Micro
16.	Transportation & communication	Landuse	Micro

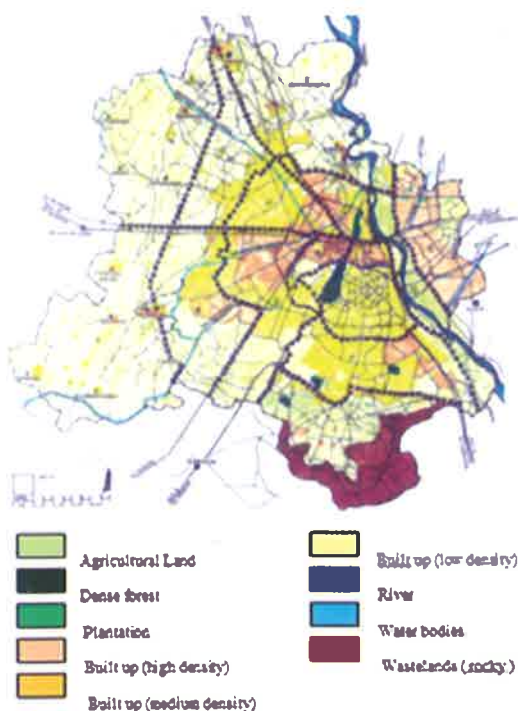


Table 3.14 Landuse and habitats: (ecore scale - large)

S.No.	LANDUSE CATEGORY	ECOSYSTEM TYPE	HABITAT ** TYPE
1	BUILT UPLAND (High/moderate density)	Terrestrial	Cities & cities
2	BUILT UPLAND (Low density)	Terrestrial	Open scrub
3	AGRICULTURAL LAND (Cultivated)	Terrestrial	Open Scrub
4	AGRICULTURAL LAND (Fallow)	Terrestrial	Woodland monoculture
5	FORESTS (Dense / Open scrub)	Terrestrial	Woodland
6	FORESTS (Plantation)	Terrestrial	Woodland monoculture
7	FORESTS (Open scrub)	Terrestrial	Open scrub
8	WASTELAND (Saline lands)	Terrestrial	Open plains
10	WASTELAND (Rocky)	Terrestrial	Rocky
11	WATER BODIES (River stream/ drain)	Aquatic	Fresh water wetlands
12	WATER BODIES (Canals)	Aquatic	Fresh water wetlands
13	WATER BODIES (Lakes / ponds)	Aquatic	Fresh water wetlands

** This classification is subject to change depending on availability of scientific data. At present it is somewhat subjective.



Table 4.3. Land use and biodiversity value (meso level)

S.No.	USE ZONE	HABITAT ** CATEGORY	BIODIVERSITY VALUE**
1	RESEIDENTIAL		
	Primary Residential Zone	Open scrub	Medium to high
	Mixed Residential Zone		
	Unplanned Informal Residential Zone		
2	COMMERCIAL		
	Retail Shopping Zone		
	General Business Commercial District centers	Cliff & caves	Medium
	Wholesale, Food Warehousing, Regulated Markets.		
3	MANUFACTURING		
	Service and Light industry	Open scrub	Low
	Extensive & Heavy Industry		
	Special Industrial Zone Hazardous, Chemical and Noxious		
4	PUBLIC & SEMI-PUBLIC		
	Govt. Semi Govt. Public Offices	Cliff & caves	Medium
	Govt. Land Use (Undetermined)	Open scrub to woodland	Medium to high
	Educational & Research	Open scrub to woodland	Medium to high
	Medical & Health	Open scrub to woodland	Medium to high
	Social, Cultural & Religious	Open scrub	Low to medium
	Utilities & Services	Open scrub	Low to medium
5	RECREATION		
	Cremation & Burial Grounds	Open scrub to woodland	Low to medium
	Playgrounds, Stadium, Sports Complex	Open scrub to woodland	Medium to high
	Parks & Gardens (Public open spaces) Multipurpose Open Space (Maidan)	Open scrub to woodland	Medium to high
6	TRANSPORTATION & COMMUNICATION		
	Roads	Corridors	Low
	Railways	Corridors	Low
	Airport	Open scrub	Low
	Sea port & Dockyards		
	Bus Depots Truck Terminal & Freight Complexes.		
	Transmission & Communication	Corridors	Low
7	AGRICULTURE		
	Agriculture	Open scrub	Low
	Forest	Woodland	High
	Brick Kilns & Extractive Area Waste B dumps	Wetland	High
8	SPECIAL AREA		
	Old Built-up Areas		
	Heritage & Conservation		
	Scenic Value Areas		
	Village Settlement Other Uses	Open scrub to woodland	Low to medium

** This classification is subject to change depending on availability of scientific data. At present it is somewhat subjective.



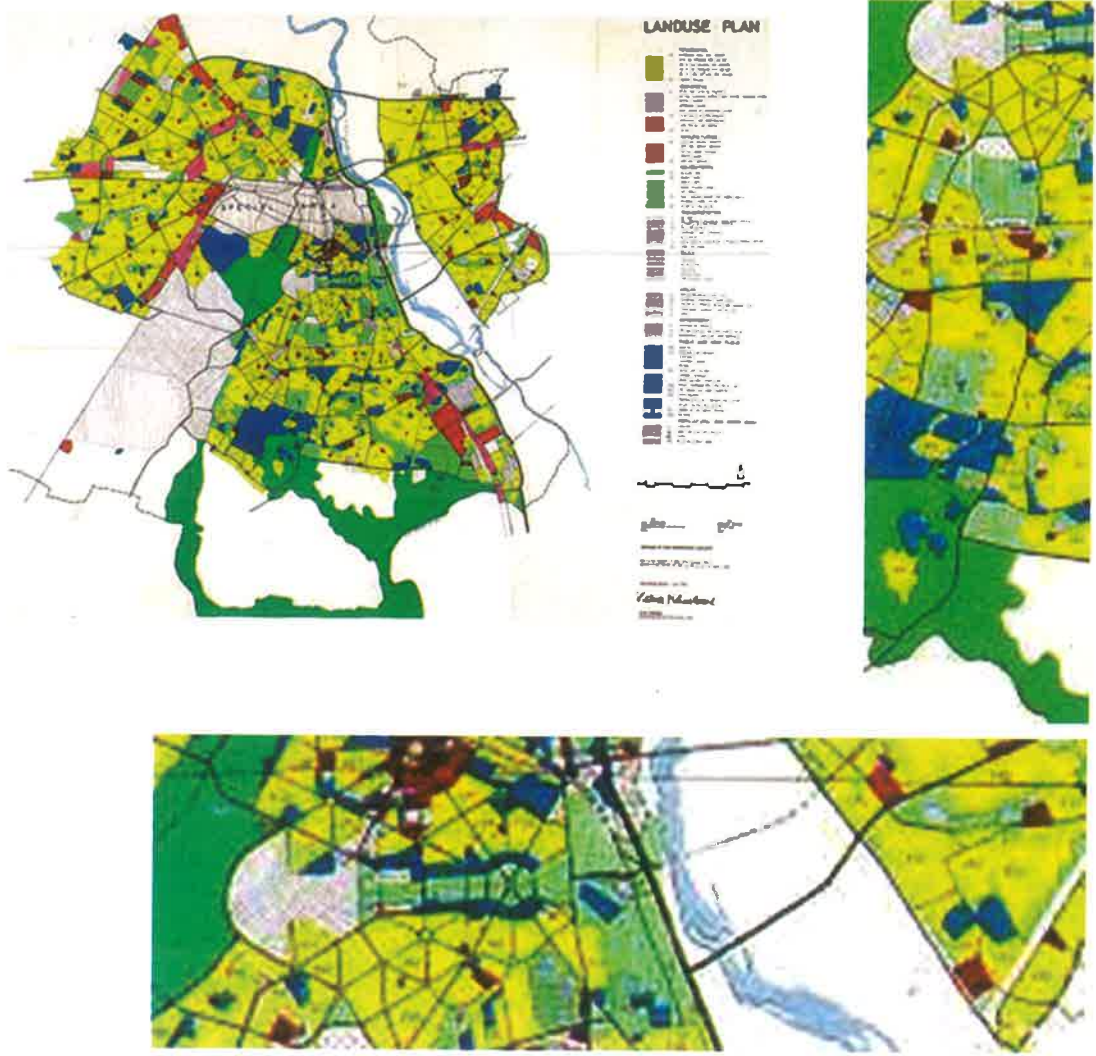
GRADIENT ANALYSIS:

A quick observation of the landuse map (proposed 2001) indicates that the Central Vista seems to be the heart of the city. Radial transacts from the centre towards four directions are shown

Critical habitat rich transacts which need detailed assessments to protect their biodiversity are Transact III and IV, (in transact I and II the portions of the Ridge, Cantonment and Pusa Institute are already under protection).

Transact III (south) - Central Vista, Lutyens Delhi, Safdarjung airport, Residential area(low density), Qutub Institutional area, South Central Ridge

Transact IV (east) – Central Vista, India Gate, National Stadium, Old Fort/ Pragati maidan, Yamuna flood plains, Sanjay Lake/Residential area (high density), Gazipur drain, Hindon cut, Residential Area (high density)





ROPOSED LANDUSE 1981-ZONE F

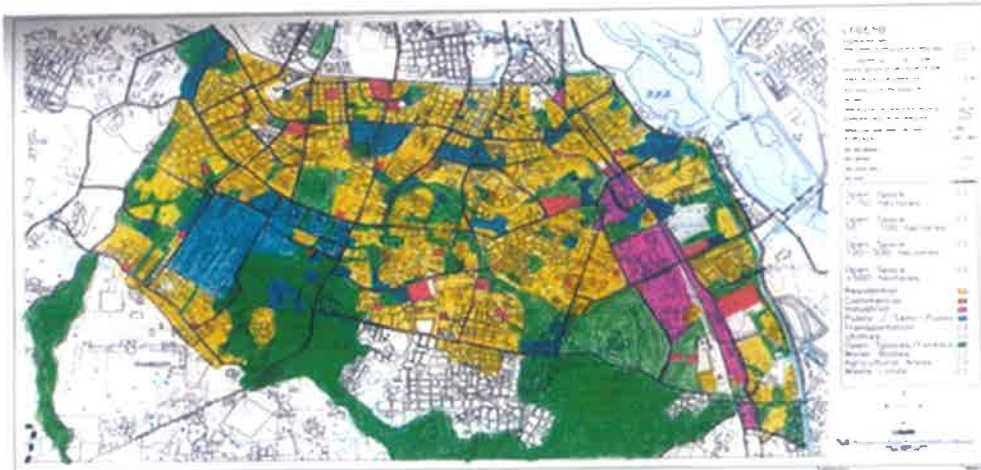


Fig: Landscape Units (patches)

SYMBOL	HABITAT	AGE	VEGETATION DENSITY	VEGETATION STRUCTURE	FAUNAL COMPOSITION	SOIL	LOCALITY
	WOODLAND	> 50 YRS	> 40%	TREES, SHRUBS, CLIMBERS, GRASSY UNDERGROUNDS	MAMMALS, AMPHIBIANS, REPTILES, BIRDS, ANTIPODIDS		UNIVERSITY, CITY PROPER, UNIVERSITY CENTRAL, UNIVERSITY WEST, UNIVERSITY EAST
	WOODLAND	> 30 YRS	> 40%	TREES, GRASSY UNDERGROUNDS	MAMMALS, BIRDS, ANTIPODIDS		UNIVERSITY WEST, UNIVERSITY EAST, UNIVERSITY CENTRAL, UNIVERSITY PROPER, UNIVERSITY WEST, UNIVERSITY EAST
	WOODLAND	> 30 YRS	10% - 20%	Few TREES, GRASSY UNDERGROUNDS	AMPHIBIANS, REPTILES, BIRDS, ANTIPODIDS		UNIVERSITY WEST, UNIVERSITY EAST, UNIVERSITY CENTRAL, UNIVERSITY PROPER, UNIVERSITY WEST, UNIVERSITY EAST
	WOODLAND	> 30 YRS	< 10%	Few TREES, GRASSY UNDERGROUNDS	AMPHIBIANS, REPTILES, BIRDS, ANTIPODIDS		UNIVERSITY WEST, UNIVERSITY EAST, UNIVERSITY CENTRAL, UNIVERSITY PROPER, UNIVERSITY WEST, UNIVERSITY EAST
	WOODLAND	> 30 YRS	< 10%	Few TREES, GRASSY UNDERGROUNDS	AMPHIBIANS, REPTILES, BIRDS, ANTIPODIDS		UNIVERSITY WEST, UNIVERSITY EAST, UNIVERSITY CENTRAL, UNIVERSITY PROPER, UNIVERSITY WEST, UNIVERSITY EAST

Fig: Patch classification and biodiversity



Table 3.3 Fauna of Delhi (Contn 1961)

Vertebrates (Continued)	Amphibia (Continued)	Reptiles	Birds	Butterflies	Beetles	Amphibia and Fishes	
1 Leopard (<i> Panthera pardus</i>) 2 Mongoose (<i> mongoose</i>) 3 Domestic fox (<i> Canis familiaris</i>) 4 Wolf (<i> Canis lupus</i>) 5 Jackals (<i> Canis aureus</i>) 6 Otter (<i> Lutrogale</i>) 7 Mongoose - <i> mongoose</i>	1 Aquatic 2 Black frog (<i> Rana</i>) 3 Indian gharial (<i> Gavialis gangeticus</i>) 4 Mole 5 Wild Pig (<i> Sus</i>)	1 Python (<i> Python</i>) 2 Snake (<i> Naja</i>) 3 King cobra (<i> Ophiophagus</i>) 4 Snake (<i> Bungarus</i>) 5 Snake (<i> Echis</i>)	1 Common bat - <i> Rhinoptera</i>	1 Kingfisher (<i> Alcedo</i>) 2 Sparrow - <i> Sturna</i> 3 Parula 4 Common Molebird (<i> Melospiza</i>)	1 Frog (grey) 2 Frog (black and blue-red) 3 Red grass 4 Green grass 5 Blue grass 6 Grey grass 7 Peacock 8 Dove 9 Dove 10 Dove 11 Dove 12 Dove 13 Kingfisher 14 Sparrow 15 Sparrow	1 Lizard House lizard Garden lizard 2 Snake Cobra (<i> Naja</i>) Krait (<i> Bungarus</i>) Viper Cicada - <i> Cicada</i> Kat snake - <i> Coluber</i> Snake Python - <i> Python</i> Wolf snake - <i> Coluber</i> Sand snake - <i> Echis</i> Cobra - <i> Naja</i> Wolf snake - <i> Coluber</i>	1 Turtle Fresh water <i> Labeo</i> Sea water - <i> Labeo</i> 2 Trout 3 Indian bull frog 4 Fish Sole Labeo Carp Mussel Eel Mussel Crab

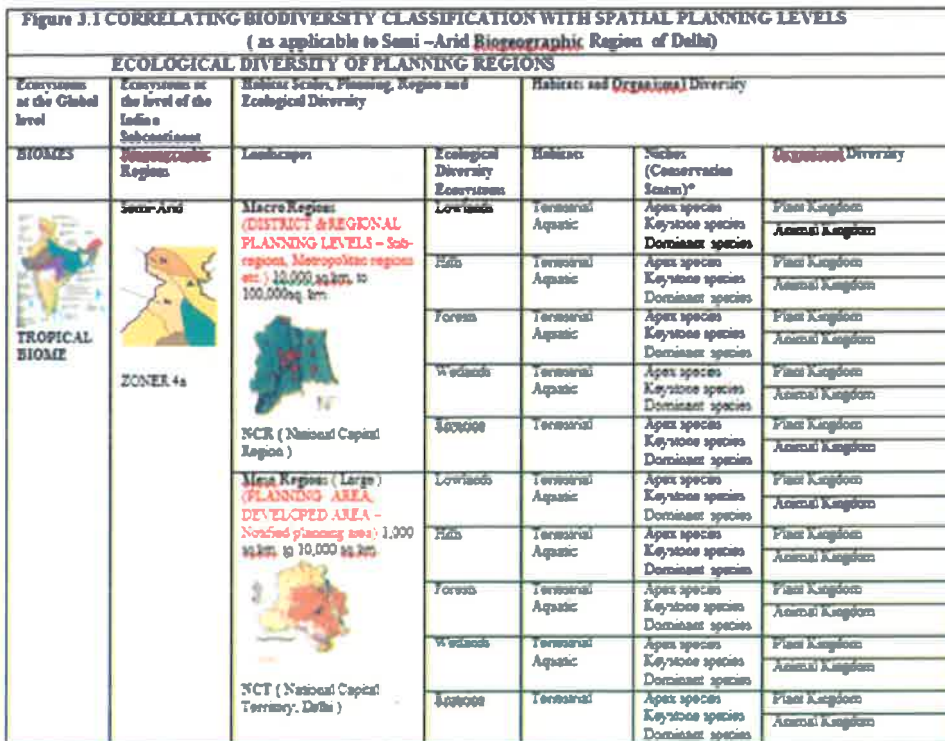




Fig.4.1 HABITAT EVALUATION MATRIX-QUALITATIVE

LANDUSE CATEGORY	Floral composition				Arthropods (Invertebrates)	Faunal composition (Vertebrates)					BIODIVERSITY VALLEY	ENVIRONMENTAL ROLE
	Trees	Shrubs	Ground Cover	Climber		F	AM	RE	B	M		
Agricultural land	R	Crops	Crops	Crops	O	-	R	O	O	R	Medium to High	WR
Dense forest	A	A	A	A	A	-	A	A	A	A	Highest	WR,PC,CC
Plantation	A	O	O	O	O	-	-	R	R	R	Medium to High	WR,PC
Build up (high density)	-	O	-	-	R	-	-	R	R	R	Low	
Build up (medium density)	O	O	O	O to R	O	-	-	O	O	O	Medium	
Build up (low density)	A	A	A	O	O to A	-	-	O	A	O	High	WR,CC
River	-	O to R	-	-	O to R	A	A	R	A	R	High	WR,CC
Water bodies and adjacent areas	O to A	A	A	O	O to R	A	A	O	A	O	Low	
Waste lands	R	-	-	-	R	-	-	O to R	O to R	O to R	Low	
Waste lands (rocky)	-	-	-	-	-	-	-	R	to R	to R		

R - rare, O - occasional, A - abundant
 (F-fishes, AM-amphibians, RE-reptiles, B-birds, M-mammals)
 WR - Water Recharge, PC - Pollution Control, CC - Climate control

The above evaluation is also represented in Map 4.1 for NCT Delhi

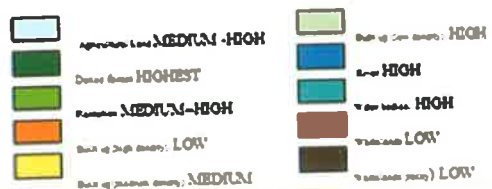
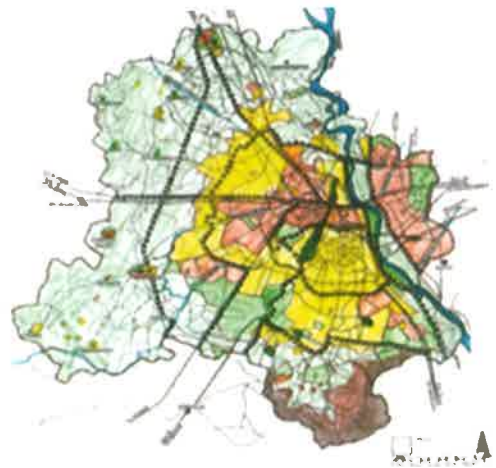
Quantitative Assessment

The first step of a HEP application consists of

- (1) Defining the study area,
- (2) Delineating cover types, and
- (3) Selecting evaluation species.

The study area should include those areas where biological changes related to the land-or water-use are expected to occur. "Evaluation species" (Or indicator species are used in HEP to quantify HUs i.e. Habitat Units).

- Species known to be sensitive to specific land-use actions. The species selected with this approach serve as "early warning" or indicator species.
- Species that perform a key function in an ecological community because of their roles in nutrient cycling or energy flows.
- Species that represent groups of species, which utilize a common environmental resource (guilds). ("Feeding guilds" are defined in terms of feeding mode (e.g. carnivore, herbivore, or omnivore) and strata locations in ecosystems from where the foods are obtained e.g.: canopy, shrub layer, or surface).
- Species with high public interest, economic value, or both.





HABITAT SUITABILITY INDEX MODEL FOR CHITAL OR SPOTTED DEER:

Model Assumptions – measurable variables

The assumptions made in developing the HSI model for the summer habitat of *chital* are as under:

Percentage of grassland by area, varying between 40% to 60% of the area is considered ideal. Main grass height of 65 cm is considered most suitable. Up to 50 percent tree canopy closure there is an ideal amount of grass/herbage growth available for chital.

Flat to gently rolling country up to 8 percent slope

All potential chital habitat encountered within a radius of 2 km with a water source as the focal point. Presence of at least one waterhole per 12.5 Sq.km.

Minimum habitat area

Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before an area will be occupied by a species. The home range of a small herd of chital in Chilla sanctuary was calculated to be approximately 10 sq. km.

On drier habitats the deer moves considerably in larger sanctuaries, areas less than 100 sq. kms. is insufficient, especially if the area is isolated from forest areas.

Habitat variable	Cover type	Life requisite
Percentage of Grass Land in the forest	MDF, DDF,TF	
Mean height of the Grass	MDF, DDF,TF	
Percentage tree Canopy closure	MDF, DDF,TF	Food /Cover HSI
Topographic diversity	MDF, DDF,TF	
Distribution of water	MDF, DDF,TF	Water

Relationships of Habitat variables, Cover types, and Life requisites to the HSI model for *Chital* during summer.

MDF- Moist Deciduous Forest, DDF- Dry Deciduous Forest, TF- Tropical Thorn

HSI for the entire study can be computed by a weighted mean of the HIS of each area, as below;

$$HSIT = \frac{\sum_{i=1}^n (HSI_i) A_i}{\sum_{i=1} A_i}$$



Where,

HSIT = HSI for total study area

HSI_i = HSI for with response unit calculating using equation (1) or (2)

A_i = the surface area of the ith response unit.

n = the number of response units.

ANY BIODIVERSITY ACTION PLAN COULD INCLUDE HABITAT MAPPING OF AS A BASIC CONSERVATION DOCUMENT SIMILAR TO LISTING OF HERITAGE BUILDINGS. THIS SHOULD INCLUDE:

Protected Areas

Ecosystem Diversity

Green Landuses

Critical Gradients

Greenways- Green Landscape Structure- Patch & Corridor

Strategy for the Conservation of the Habitats/Biodiversity

Quantitative assessments of Biodiversity Index and Gradient Analysis involving application of landscape metrics should be attempted at to identify the relative biodiversity values of areas, to support the cause of their conservation. Listing of Indicator species for assessing the status of the environment needs to be available for rapid impact assessments.

ZOOS FORM PART OF LOCAL BIODIVERSITY ACTION PLAN AND BIODIVERSITY CONSERVATION HERE COULD INCLUDE:

Habitat Mapping

Listing of Ecosystem Diversity and Species Diversity

Assessment of Biodiversity Value, Biodiversity Index

Enhancement of Critical Gradients and Greenways (Major Role of Landscape Architects)

Strategy for the Conservation of the Habitats/Biodiversity

LINK TO CONSIDERATIONS OF LBSAP:

There are three main considerations that should be taken into account when designing an LBSAP:

Tangible biodiversity;

External/broader influences; -biosafety, climate change, economic pressures

Local governance mechanisms for improving the city relationship to biodiversity.

- Stake holder involvement, institutional set up, landuse planning.



PLANNING FOR ENRICHMENT

PRESENTED BY –



MONIKA FIBY

- MASTER OF LANDSCAPE ARCHITECTURE
- FOUNDER OF THE ZOOLEX ZOO DESIGN ORGANIZATION



BUILT-IN AND CHANGEABLE ENRICHMENT:

For planning and construction purposes, the distinction between built-in and changeable enrichment is helpful. Built-in enrichment creates environmental conditions that cannot be easily changed.

In this picture you can see a landscape that looks natural, but is totally man-made. It was built to imitate the natural environment of Grizzly bears as closely as possible. This principle has an education aspect and an animal welfare aspect. By providing animals with as many features from their natural habitat as possible we can answer animal needs that we don't even know.



**Minnesota Zoo - Russia's Grizzly Coast
(Source: www.zoolex.org)**

Unfortunately it is not always possible to replicate the natural habitat of species, particularly when they come from other climatic conditions than the location of their exhibit.

These poles were developed after field research revealed that orangutans preferably move through bamboo forest by using all four limbs when holding onto the stems. The poles have a flexible base in order to imitate the flexibility of bamboo.

Of course orangutans also swing and climb. Ropes and fire hoses are included into this enclosure. While the poles were built into the enclosure, the ropes and fire hoses were added later and can be changed.

A requirement for the changeable enrichment in this orangutan exhibit is the gate in the picture that allows access for machines and keepers to the enclosures. The steel structure on the left in the picture was also built-in and serves as elevated seating place for the orangs and for fixing ropes and hoses. We have to plan the prerequisites to be built-in that we need for enrichment later on.

Small doors are a common limitation to enrichment, unless the keepers are extremely motivated. In this case the keepers have to bring in all tools in and out a small door.



Small doors are a common limitation to enrichment, unless the keepers are extremely motivated. In this case the keepers have to bring in all tools in and out a small door.

Missing and small doors are a design mistake that can cause bad welfare for keepers and animals.

In planning, we differentiate between strategic planning, masterplanning and enclosure planning. Each level is meant for specific consecutive steps of planning which have effects on the quality of the animal environment and welfare.

Level of plan	Content	Animal welfare
strategic plan	theme, species	social groups, breeding
masterplan	layout of exhibits, location, accessibility, size, form, animal management	suitability of the enclosure, neighbourhood, space use
enclosure plan, construction	barriers, landform underground, substrates, water, vegetation, access, storage space, furnishing	usability of the enclosure, built-in enrichment
operation	compensation for deficits of the enclosure and due to captivity	changing enrichment, training, rotation between spaces

In the strategic plan, the purpose or theme of the institution is decided, based on its strengths, traditions and specialities. This includes decisions on the main animal species, group composition and breeding. The number, gender and age of animals in a group and their breeding has much influence on the welfare of each individual animal. There is no general rule, however, since the needs vary extremely among species.

In the masterplan, the layout is decided. This includes the location, size and form of exhibits. Much of the suitability of an enclosure is decided in the masterplan, such as the quantity of sun, shade, humidity, water, vegetation, air quality and temperature. If an enclosure is not suitable for a species because of decisions in the masterplan, it is very difficult and costly or even impossible to make it suitable. For example the lack of natural light in a building can hardly be rectified later.

The enclosure plan decides on borders and barriers, viewing spots for visitors as well as for the animals, access gates and doors, ramps, water and electricity and storage space for changeable enrichment. It also decides on animal management, which materializes in separation enclosures and shift doors. These aspects determine the usability of the enclosure for animals and their caretakers.



While a location according to the masterplan may be suitable, the enclosure also has to be built correctly to be useful for the animal.

The built-in enrichment is decided in the masterplan, in enclosure plans and in construction. The changeable enrichment is added during operation. It compensates for deficits of the enclosure and deficits due to captivity, such as a lack of stimuli.

The following are examples of built-in enrichment:



This cave was built for the bear to rest and hibernate. It was built with a slope so that water cannot run inside. The exposition of its opening keeps wind and rain away.

The location and exposition of the cave was decided in the masterplan, its form and slope in the enclosure plan.

**Bear Sanctuary Arbesbach – Brown Bears
(Source: www.zoolex.org)**

It was decided in the masterplan to equip this greenhouse to imitate the daily and seasonal cycles of light, temperature and humidity on Aldabra. According to the enclosure plan, the ground is varied to allow a flat water pool, easy to clean concrete surface for feeding, soft mulch and sand for the tortoises and soil for the plants.



**Odense Zoo-Aldabra Tortoises
(Source : www.zoolex.org)**



This cage was built for the purpose of medical training and is very popular with the bears. An additional training set-up in view of the visitors gives them the opportunity to observe the training and to learn about animal care.



Research has shown that visitors appreciate that the zoo cares for its animals when they see enrichment that they understand as enrichment. Enrichment therefore should be explained to the visitors.

◦ **Bear Sanctuary Arbesbach – Brown Bears**
(Source: www.zoolex.org)



Bear Sanctuary Arbesbach – Brown Bears
(Source: www.zoolex.org)

Bear enrichment at the bear sanctuary in Arbesbach, Austria, is explained in a manual for the visitors. This manual was produced in cooperation with the keepers. One can find it for download on ZooLex (www.zoolex.org/research.html).



Melbourne Zoo - Orangutan Sanctuary
(Source: www.zoolex.org)



Research has shown that toys can be misleading in that wild animals may be seen as tame or pets. The positive effects of human toys on wild animals therefore should be explained, or their use be restricted to special events or abolished when there are more natural alternatives.



(Source: www.zoolex.org)



(Source: www.zoolex.org)

Often times, objects used in enrichment are left overs from human use. How can people know that they are not garbage, but being introduced on purpose?

To avoid misunderstandings, the positive effects of such objects on animals therefore should be explained, or their use be abolished when there are more natural alternatives.

Bear enrichment can be done in many natural looking forms such as this frozen fruit and vegetable cocktail.



(Source: www.zoolex.org)



Built-in enrichment such as a creek, trees and rocks often are not recognized as enrichment, but as decoration. The ibex train their muscles and balance on steep rocks and also wear off their hooves when climbing between different food sources - a hay rack, branches and fresh grass - or sun and shade. This should be explained to the visitors to get them interested in the animals.

The types of enrichment that should be explained to visitors include objects whose functioning is not obvious, human toys, garbage look-alikes and features that were built-in for animal welfare. Planning for enrichment also includes planning the communication about enrichment.

More examples can be found on the ZooLex website and on the website of The Shape of Enrichment.

Built-in Enrichment

- landform (slope, cliff, variation)
- sun and wind (smells) exposition
- windows (lookout), skylights
- heating (floor, wall, lamps)
- usable space (top open or meshed, shelters, trees, hot wire)
- lookout points (trees, rocks, hills)
- places for various substrates
- pool depth, creek, waterfall, water jets shower, mister
- surfaces for fixing furniture
- diversity of spaces (sections)
- keeper accessibility (training wall, vehicle gates, doors, shift corridors)
- barriers to neighbours (solid, mesh, gates)

Changeable Enrichment

- substrates
- furniture
- plants
- exchangeable items
- daily management routines
- conspecifics
- co-habitants of other species
- neighbours
- rotation
- training
- types of food
- food processing
- food presentation



AN OVERVIEW OF NATIONAL ZOOLOGICAL PARK, NEW DELHI



PRESENTED BY:

AMITABH AGNIHOTRI

IFS, DIRECTOR, NZP



NATIONAL ZOOLOGICAL PARK HISTORY:

National Board for Wildlife, 1952: Recommendation
Mr. N.D. Bachketi: 1st Director 1955
Major Weinman, Director, Ceylon Zoological Garden
Carl Hagenbeck: 1956
Inauguration 1st November 1959

BASIC STATISTICS:

Area: 214 acres
Visitors: 1.7 Million Every Year
Visitors Profile:
From Delhi: 39.3 %
Outside Delhi: 50.17 %
From Abroad: 10.15 %
Revenue: Rs. 4.00 Crores
Expenditure: Rs. 8 Crores, Approx.

NATIONAL ZOOLOGICAL PARK – SPECIES:

<u>Species</u>	<u>Indian</u>	<u>Exotic</u>
Mammals	34	12
Birds	35	18
Reptiles	08	01
Total	77	31

NATIONAL ZOOLOGICAL PARK:

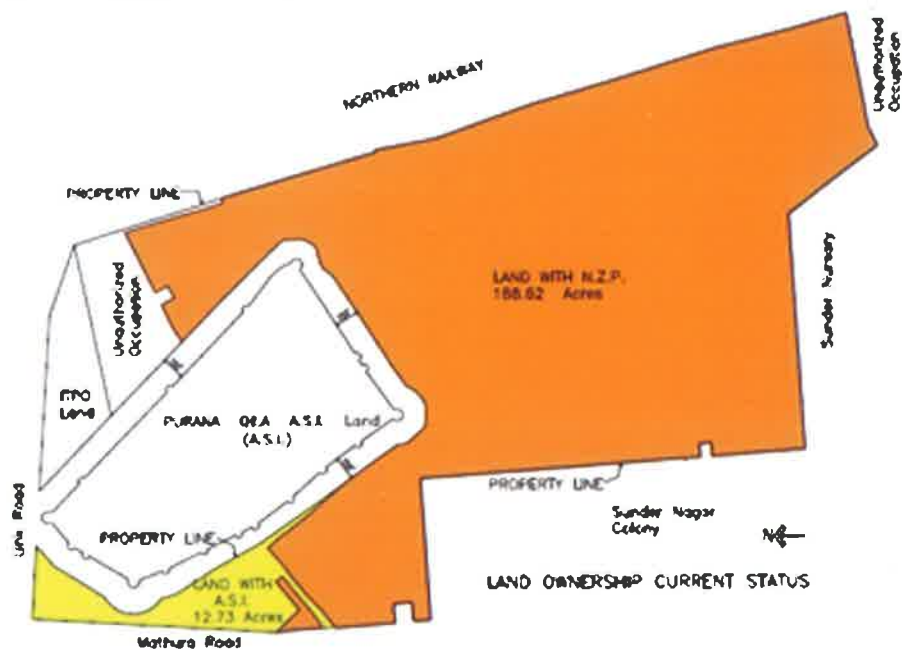
Original Layout

Asian Continent: Tiger, Lion, Rhino, Thamin, Leopard, Sambar, Cheetal etc.
African Continent: Chimpanzee, Hippo, African Lion, Ostrich, Giraffe etc.
American Continent: Jaguar, Puma, Macaws etc.
Australian Continent: Kangaroo, Emu, Cassowary etc.





NATIONAL ZOOLOGICAL PARK AND SURROUNDINGS:





NATIONAL ZOOLOGICAL PARK – CONSERVATION BREEDING PROGRAMME:

1. Sanghai Deer
2. Indian Rhinoceros
3. Asiatic Lion
4. Bengal Tiger
5. Red Jungle Fowl

Sanghai Deer

In 1962 - 3 no. (1:2) from Manipur

Given in exchange - 65 no.

Existing population - 58 no.

Indian Rhinoceros

In 1965 - 2 no. (1:1)

Given in exchange - 4 no.

Existing population - 3 no.

Asiatic Lion

In 1962 - 2 no. (1:1)

Given in exchange - 16 no.

Existing population - 07 no.

Bengal Tiger

In 1962 - 9 no. (4:5)

Given in exchange - 47 no.

Existing population - 06 no.

Red Jungle Fowl

In 2000 - 5 no. (2:3)

Given in exchange - 4 no.

Existing population - 99 no.



MASTER PLAN:

Vision

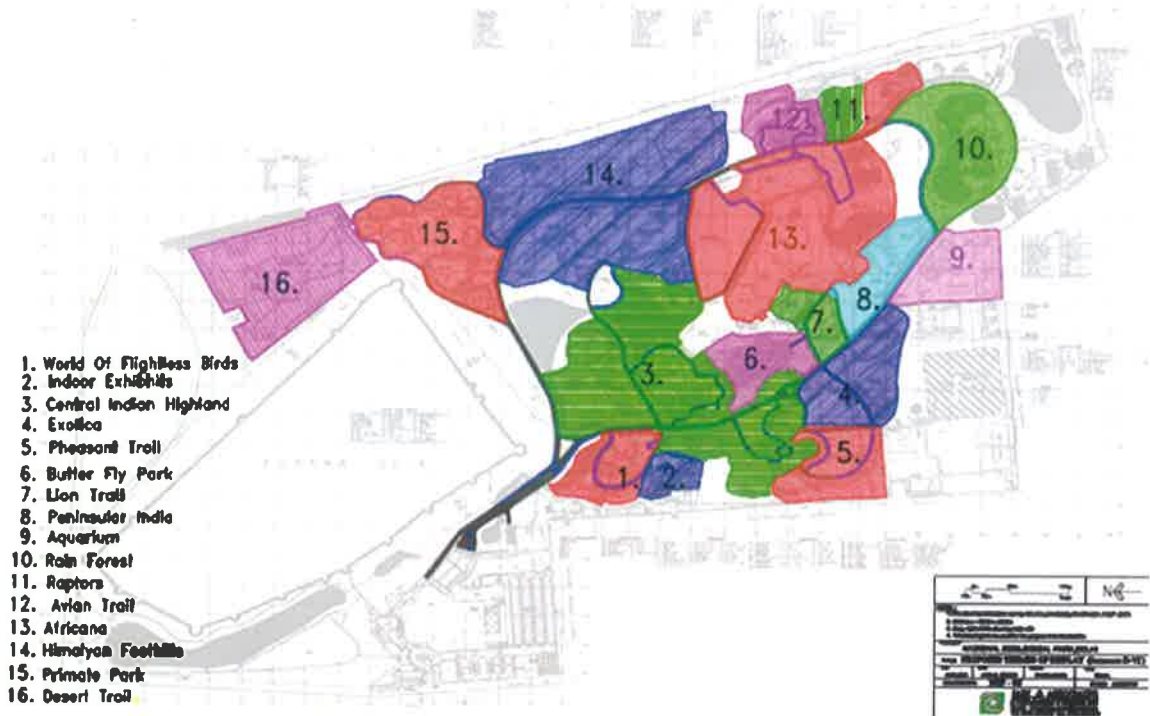
MASTER PLAN: FUTURE OBJECTIVES:

- Animal care
- Visitor experience and education
- Wildlife preservation
- Sustainability
- Research

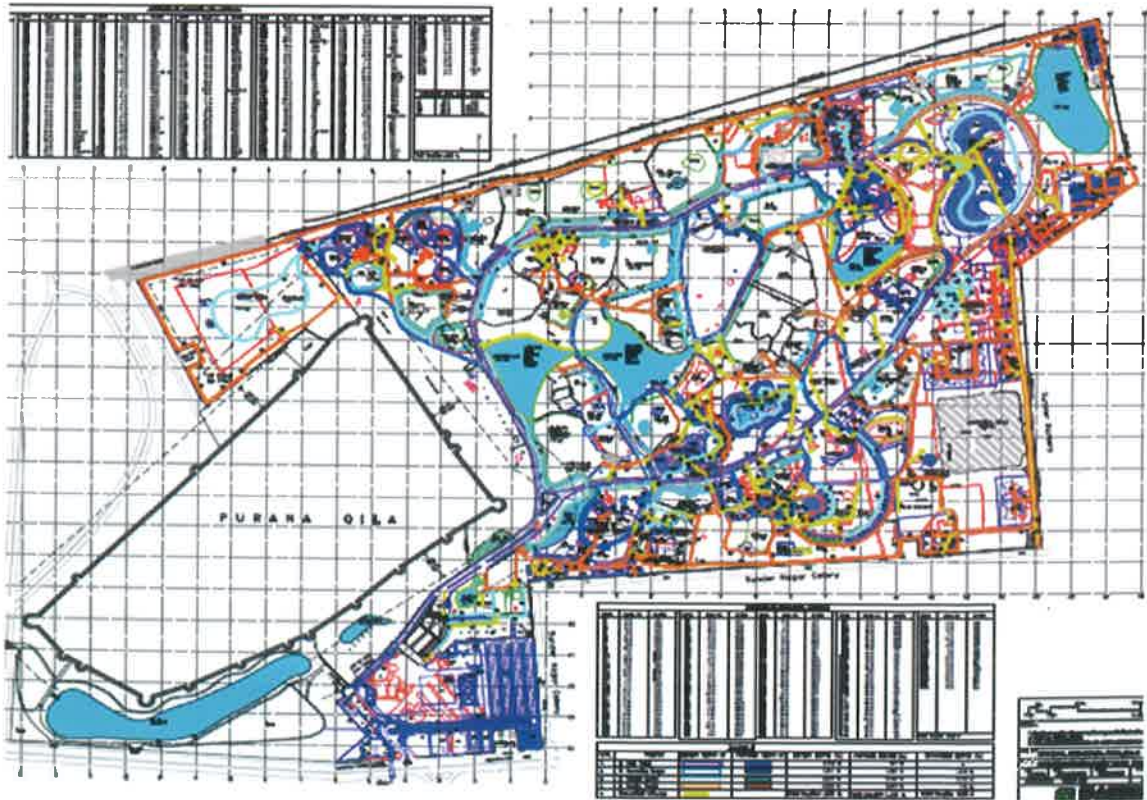
MASTER PLAN: STRATEGIES:

- Core competency
- Strengthen and upgrade human resource
- Strengthen and upgrade organizational structure
- Upgrade infrastructure and services





IMAGES OF THE NATIONAL ZOOLOGICAL PARK









Briefing for field Exercise & evaluation of design at National Zoological Park,

New Delhi

Group A:

Flightless Birds [Coordinator: Prof. Dr.Surinder Suneja, SPA]

Group B:

Tiger enclosure (including White tiger) [Coordinator: CCU, Chief Engg., MOEF]

Group C:

Primate Enclosure [Coordinator: S. K. Patnaik, CZA]

Group D:

Walk in Aviary [Coordinator: Dr. Brij Kishor Gupta, CZA]

Group E:

Amphibians Exhibits [Coordinator: Dr. Brij Kishor Gupta]

Facilitators

- Mr. B. S. Bonal
- Ms. Monika Fiby
- Mr. Jon Coe



WORLD OF FLIGHTLESS BIRDS



CO-ORDINATOR:



Prof. Dr. Surinder Suneja

Course Co-ordinator

Dept of landscape Architecture,

School of planning and Architecture ,
New Delhi

PARTICIPANTS : Sh.Rakesh Kumar, Sh.S. K. Ghatraj , Ms.Savita Punde ,
Sh.Riaz Ahamad Khan , Sh.G.N. Chitari , Sh.Raj Kumar,
Sh. Pankaj Jain, Sh.Moin Ahemad , Sh.G.M. Dangat ,
Sh.D.H. Borawake



INTRODUCTION:

Flightless birds, perhaps more than any other bird, need to be protected, if we do not want to lose them as we have lost several species in the past.

This uniquely adapted group needs to be reared in the introduced natural environment.

METHODOLOGY FOR THE DESIGN PROCESS –

The team followed a methodology for the design proposal which was as followed –

- **THE SITE PLAN**
- **APPRAISAL OF THE SITE - existing vegetation, topography, visual study of the site**
- **FLIGHTLESS BIRDS SELECTED – living pattern and requirements**
- **CONCEPT**
- **DIVISION OF ZONES**
- **BARRIERS**
- **DETAILS OF EACH EXHIBITS**



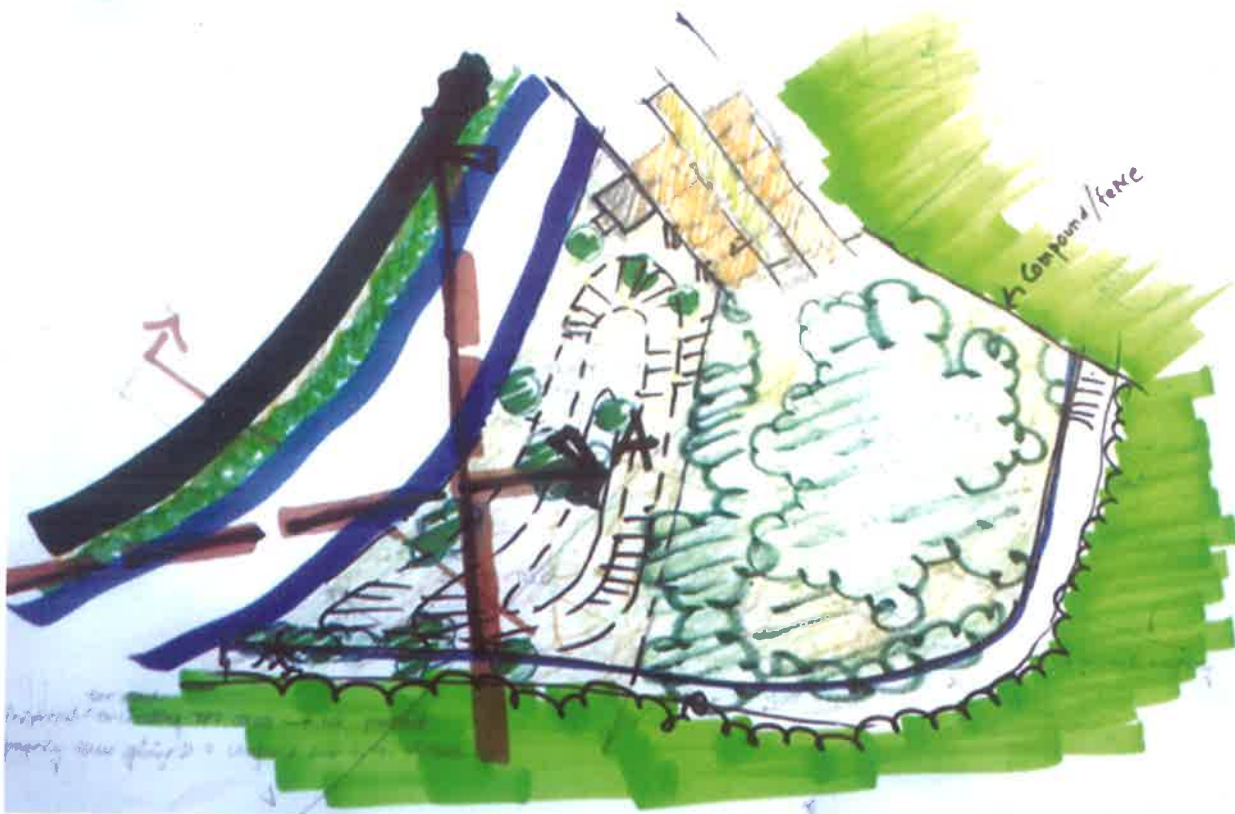
SITE LOCATION –

The site is located very near to the entrance of the National zoo of Delhi as we walk inside. It has a black swan pond running along one edge, gentle slope towards the water and a fence running at the rear edge which separates it from the enclosure of behind.



SITE PLAN





EXISTING SITE PLAN

APPRAISAL-

- Main road abutting the water edge with rolling topography in the background. This is comprised of edge planting to delineate the visitor galleria.
- Existing Prosopis which has a droopy form, acts as a habitat for migratory birds.
- Man-made structure i.e. the 'dhaba' obstructs the view of the visitors therefore it should be relocated.
- Paths laid next to the wall have a nuisance value because it causes disturbance to the migratory birds.
- Prosopis juliflora growing in the middle of the water body should be retained because it is used as a habitat for the migratory birds
- Topography- proper grading is required with reference to the existing water body.
- Railing at the periphery is about 12 feet and it should be painted in proper light green or olive green color so that it is in harmony with the nature.
- Existing trees within the plot are Azadirachta indica, Prosopis juliflora, Acacia
- Longitudinal view at the entrance leads to the point of culmination which should be realigned in terms of the lay of the water edge.



Randomly distributed *Prosopis juliflora* is providing light shade, thus creating a conducive microclimate for the birds.

60 cm deep V- shaped man- made moat has been provided with an embankment which acts as a barrier.

A 3 mt. wide service pedestrian path serves to cater to the needs of visitors.

Su- babool growing at a distance of 20 cm c-c has fuel and economic value but creates disturbance of flora.

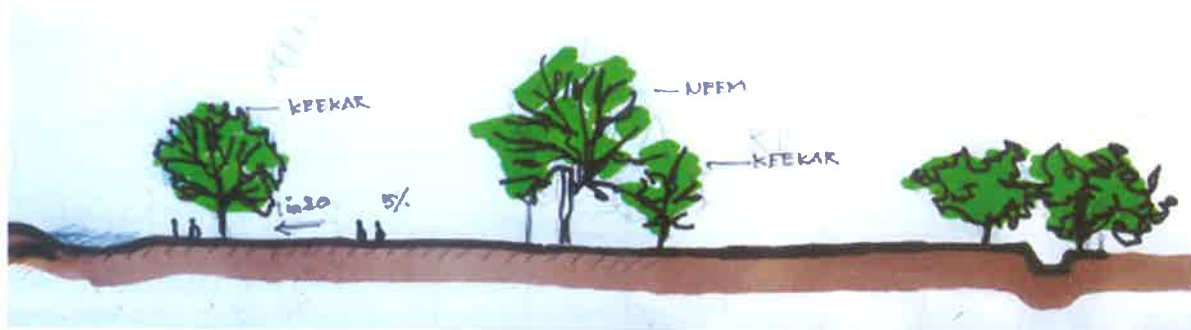




Peripheral tar road encircling the area is not perceived properly and hence it gives a confused look to the visitors.



Topography of the site- the land is flat with gradual slope towards the man-made moat.









ABOUT THE FLIGHTLESS BIRDS TO BE PROPOSED IN THE ZOO –

1. OSTRICH –

- Prefer open land and are native to the savannas and Sahel of Africa
- Height : 1.8 to 2.75 meters (6 to 9 ft)
- Ostriches can tolerate a wide range of temperatures.
- In much of their habitat, temperatures vary as much as 40° C (72 °F) between night and day. The temperature control mechanism relies on action by the bird.
- Food Habits : Mainly feed on seeds, shrubs, grass, fruit and flowers
- Behavior: Enjoy water and frequently take baths where it is available.

2. EMU –

- Native to Australia
- Height : up to 2 meters (6.6 ft) in height
- They can tolerate a wide range of temperatures i.e. thermo-regulate effectively
- Emus are also able to swim when necessary.
- Food Habits: Eat a variety of native and introduced plant species to Australia, and also insects, including grasshoppers and crickets, lady birds, soldier and saltbush caterpillars.
- Behavior : Inquisitive animals, love to follow and observe humans

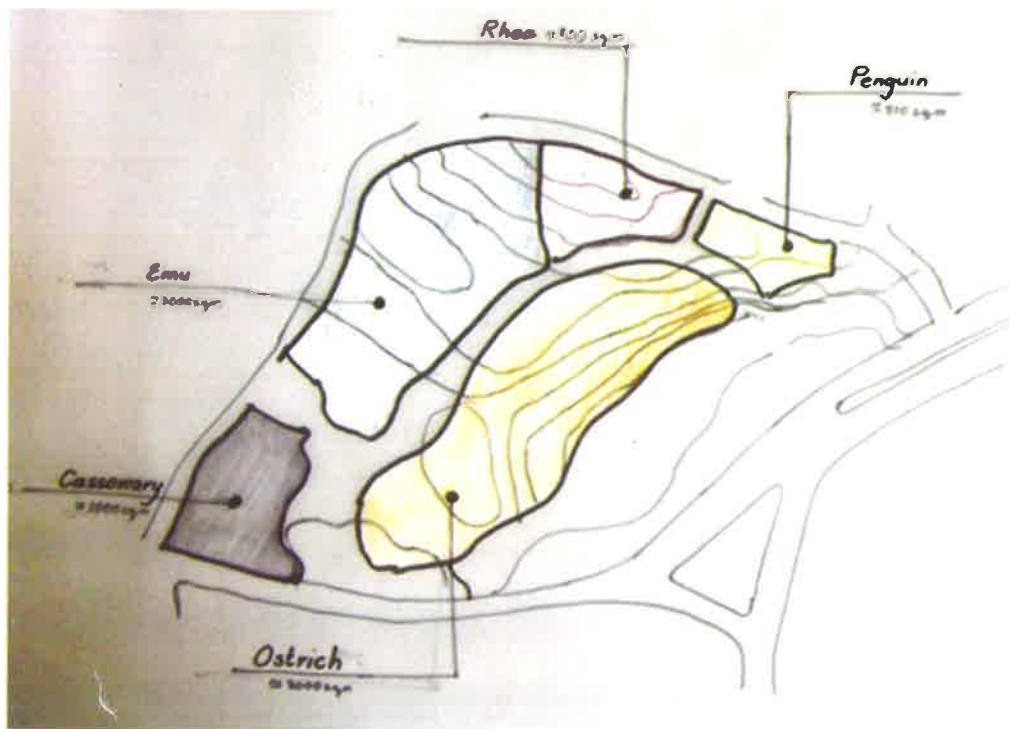
3. CASSOWARY –

- Native to the tropical forests of New Guinea
- Height : 1.5 to 1.8 metres (4.9–5.9 ft) tall
- They are good swimmers, crossing wide rivers and swimming in the sea as well.
- Food Habits: Predominantly frugivorous but they will take flowers, fungi, snails, insects, frogs, birds, fish, rats, mice, and carrion. Where trees are dropping fruit, cassowaries will come in and feed, with each bird defending a tree from others for a few days
- Behavior : Cassowaries are solitary birds except during courtship, egg-laying, and sometimes around ample food supplies



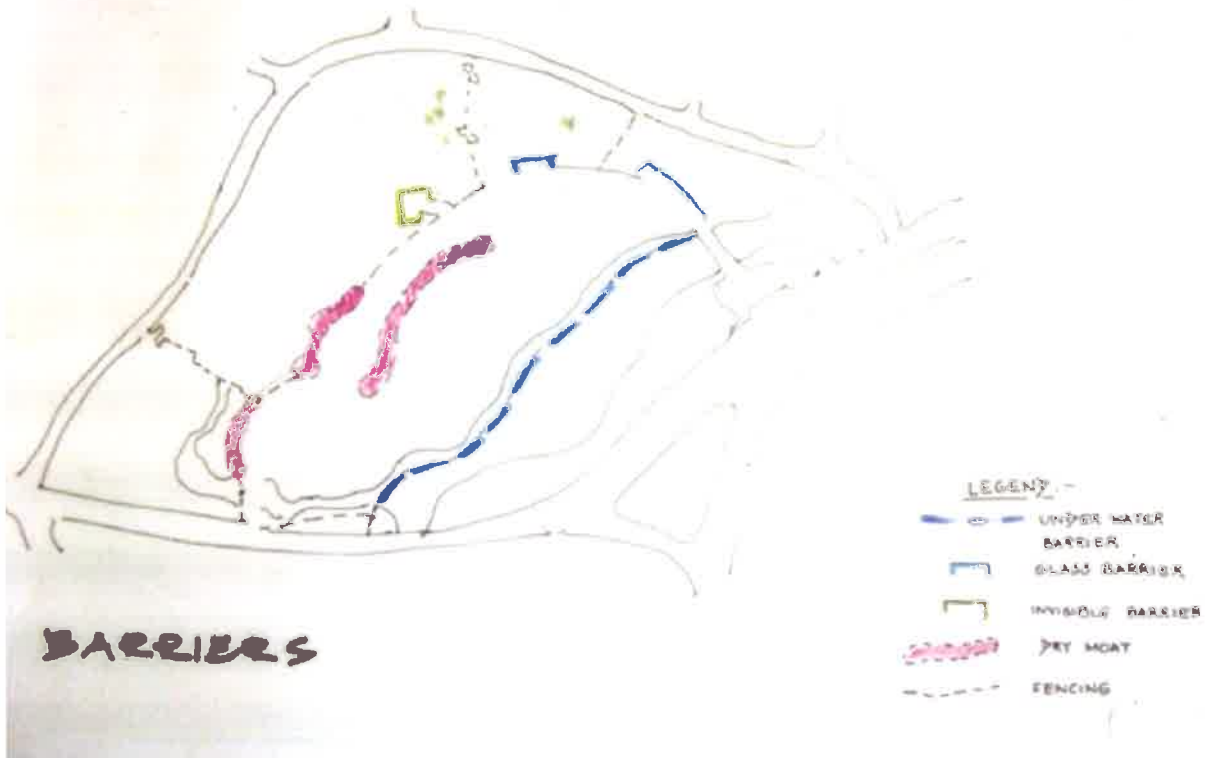
4. PENGUIN –

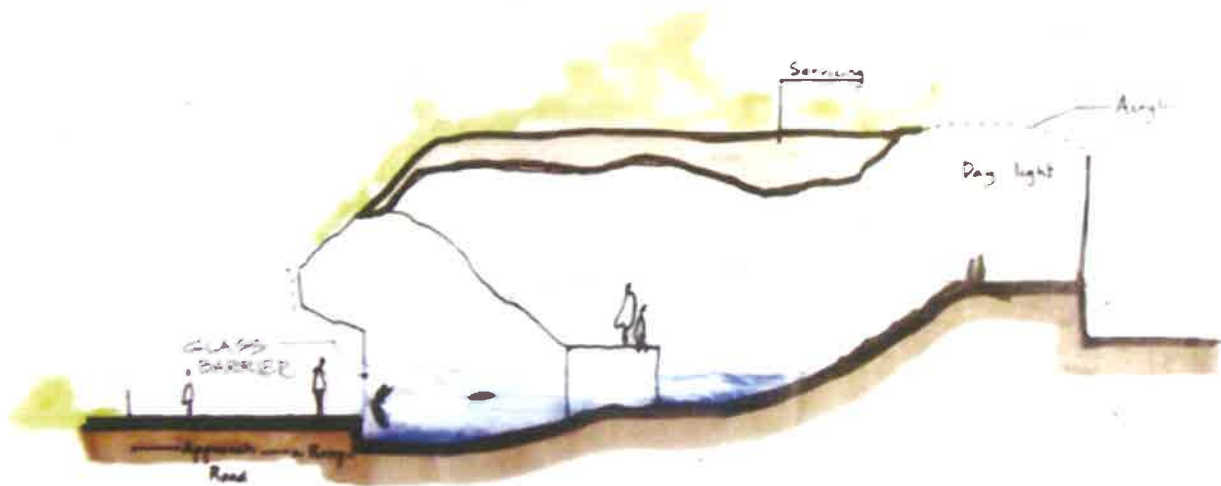
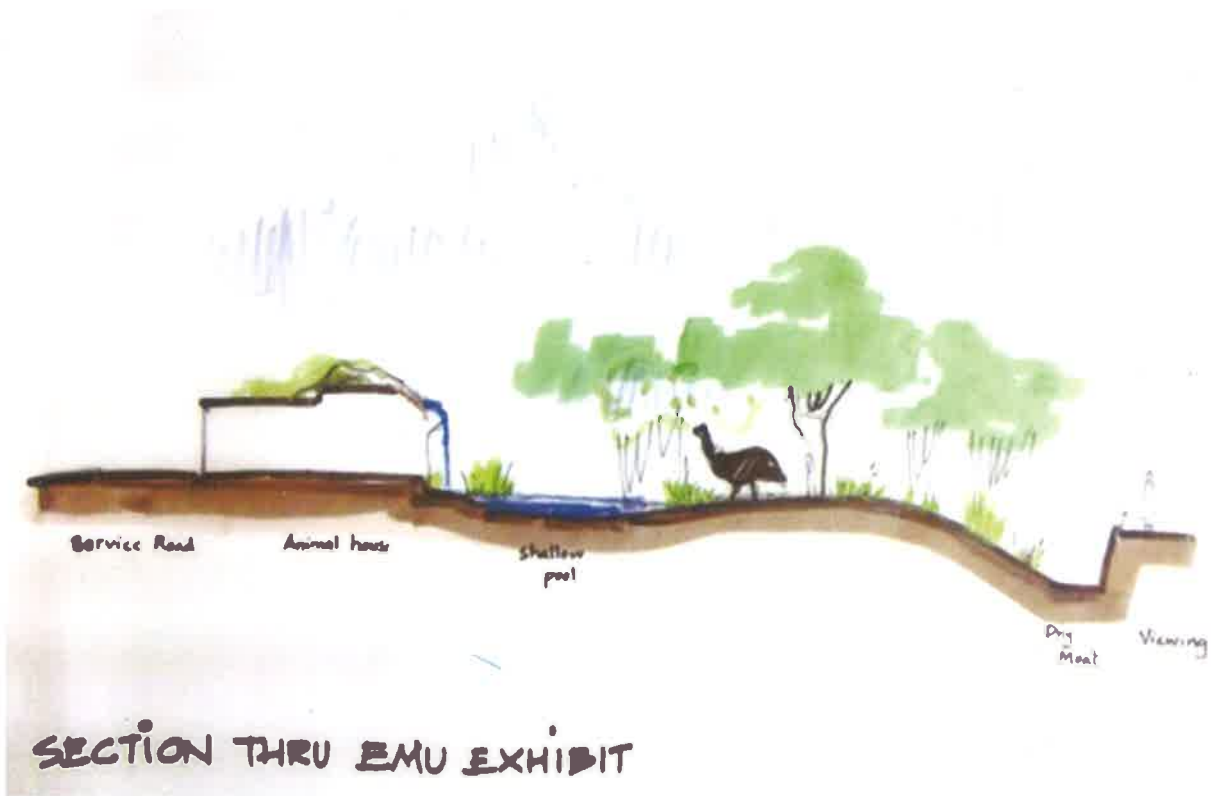
- Native to the southern hemisphere, especially in Antarctica, Several species are found in the temperate zone.
- Height : about 1.1 m (3 ft 7 in) tall
- Have a thick layer of insulating feathers that keeps them warm in water.
- Food Habits: The diets of the penguins rely mainly in fish and squid and include a small amount of krill and other crustaceans. Fish constitute 80-100% of the diet.
- Behavior: Seem to have no special fear of humans, and have approach groups of explorers without hesitation. tendency of penguins to form large groups





FLIGHTLESS BIRDS CONCEPT PLAN







PRESENTATION ON - TIGER EXHIBIT DESIGN



CO – ORDINATOR : CCU, Chief Engg., MOEF



EXISTING SITE : SITE ANALYSIS

- The existing site is quite unimpressive due to certain factors as the area of the enclosure is quite dry and dusty.
- The area lacks in camouflaged space.
- No enrichment has been made yet for the enclosure.

DRAWBACKS OF EXISTING EXHIBIT

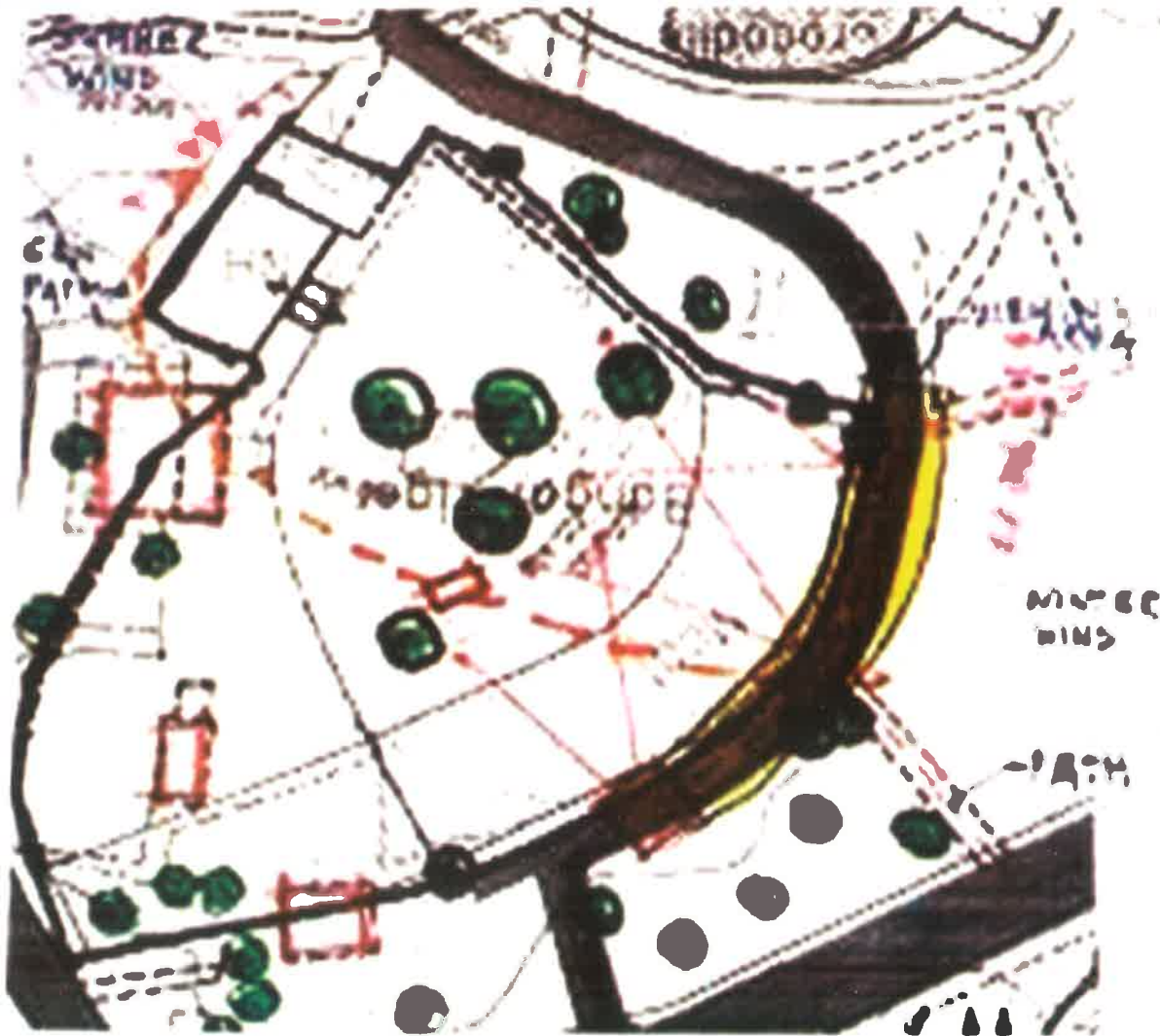
- Position of animal lower than viewers', thus seems human dominated.
- Animal holding area is visible.
- Concrete surface of moat is prominent.
- Moat is visible and gives artificial look to the enclosure.

POTENTIALS OF THE EXHIBIT

- Ideal orientation in north-south direction.
- Gets adequate daylight.
- Shady trees for protection against sun.
- Easy connectivity from primary loop.

PROPOSALS TO IMPROVE THE EXHIBIT

- Standout handrails to be made.
- Barrier to be camouflaged.
- Night shelters to be camouflaged.
- Night shelter to be improved by better ventilation and natural light.
- Kraal to be provided.

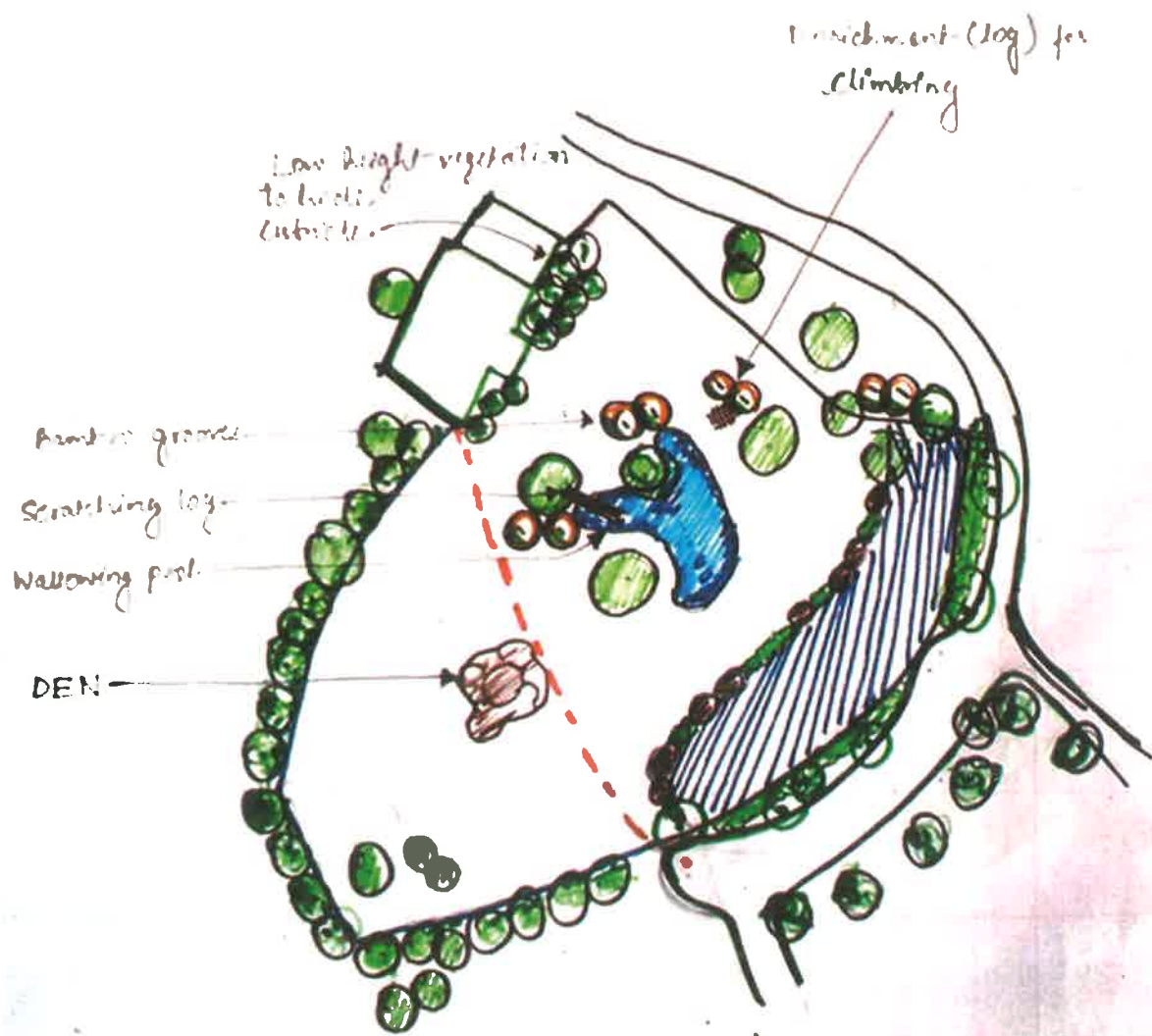


EXISTING SITE : SITE ANALYSIS



TIGER BEHAVIOUR

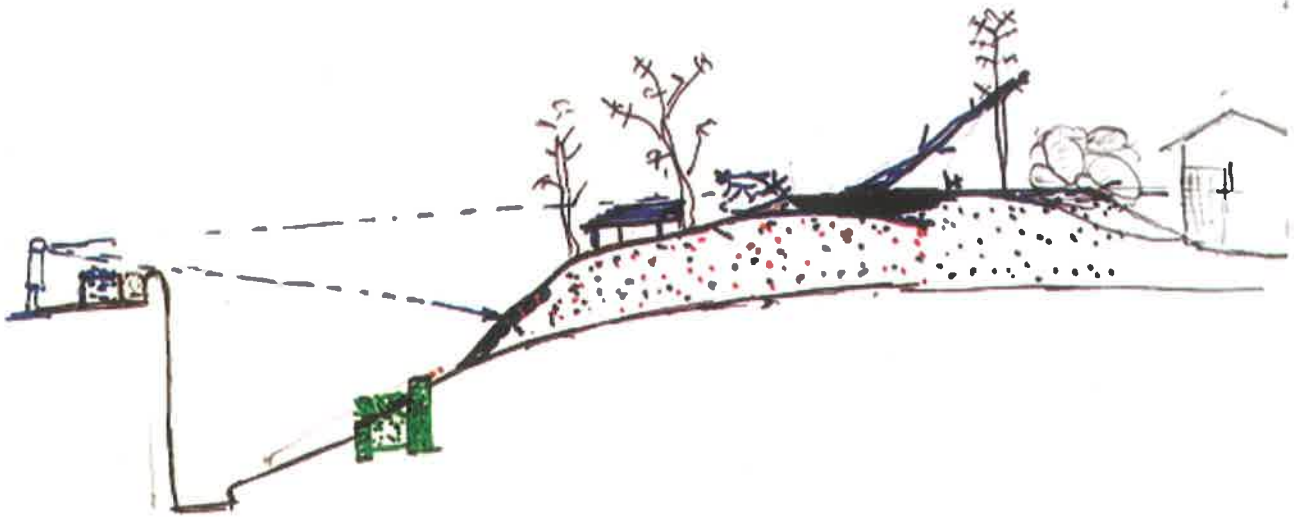
- Nocturnal
- Summer – dull, sleeping most of the time
- Winter -- look for sunlight.
- Good swimmer, climber, jumper, runner (short distances), likes water, shade, soft floor
- Attacks, bites, aggressive by nature.
- Solitary



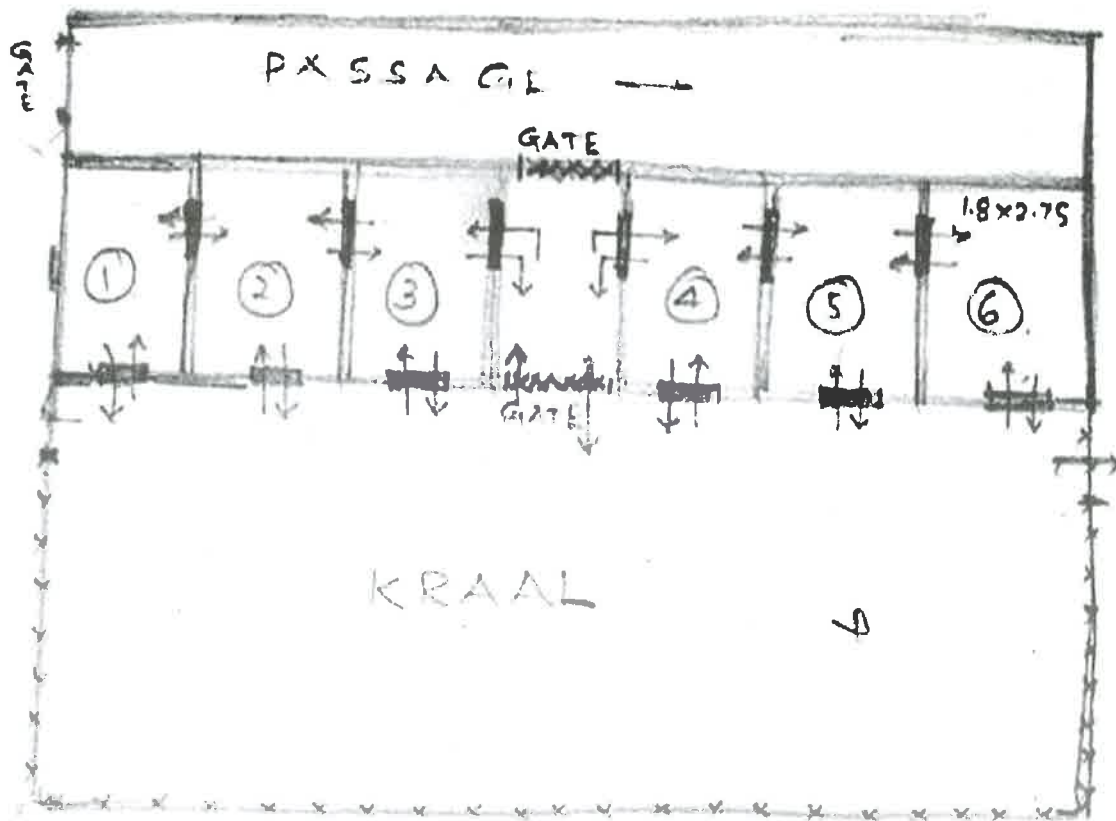
PROPOSED TIGER EXHIBIT



PROPOSED TIGER EXHIBIT



SECTION OF THE MOAT AND EXHIBIT AREA

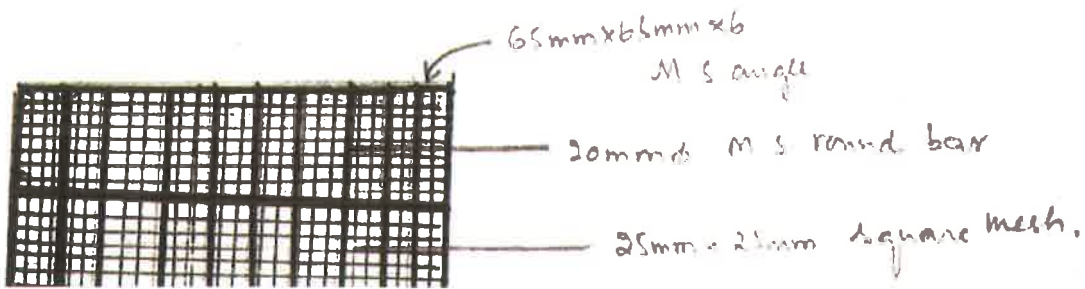




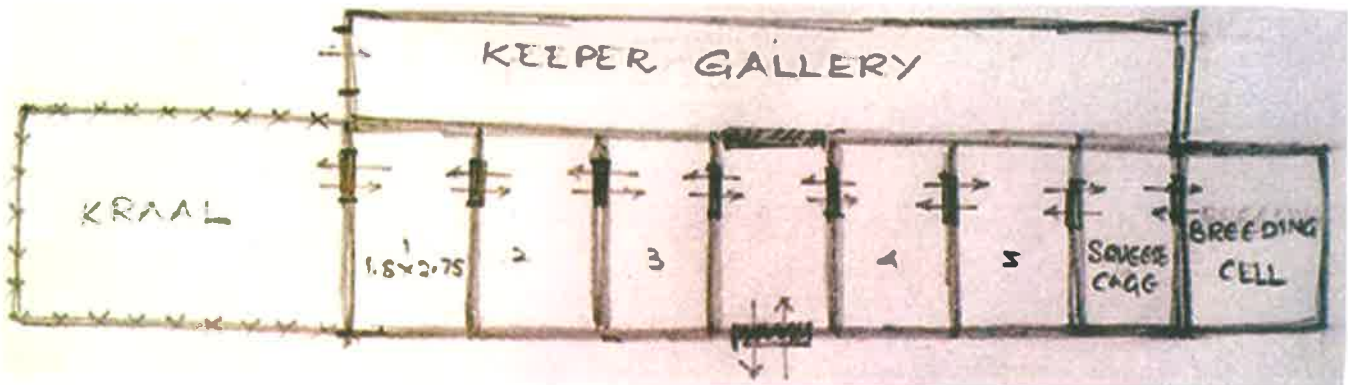
PROPOSAL PLAN

POINTS CONSIDERED IN PROPOSAL

- Kraal area and all the holding houses shall be covered
- Entry and exit from all the houses independently
- Ventilators to be provided to avoid suffocation and also for the provision of good light



VENTILATOR DETAIL



PROPOSAL FOR NIGHT SHELTER



PRESENTATION ON PRIMATE ENCLOSURES EXHIBIT DESIGN



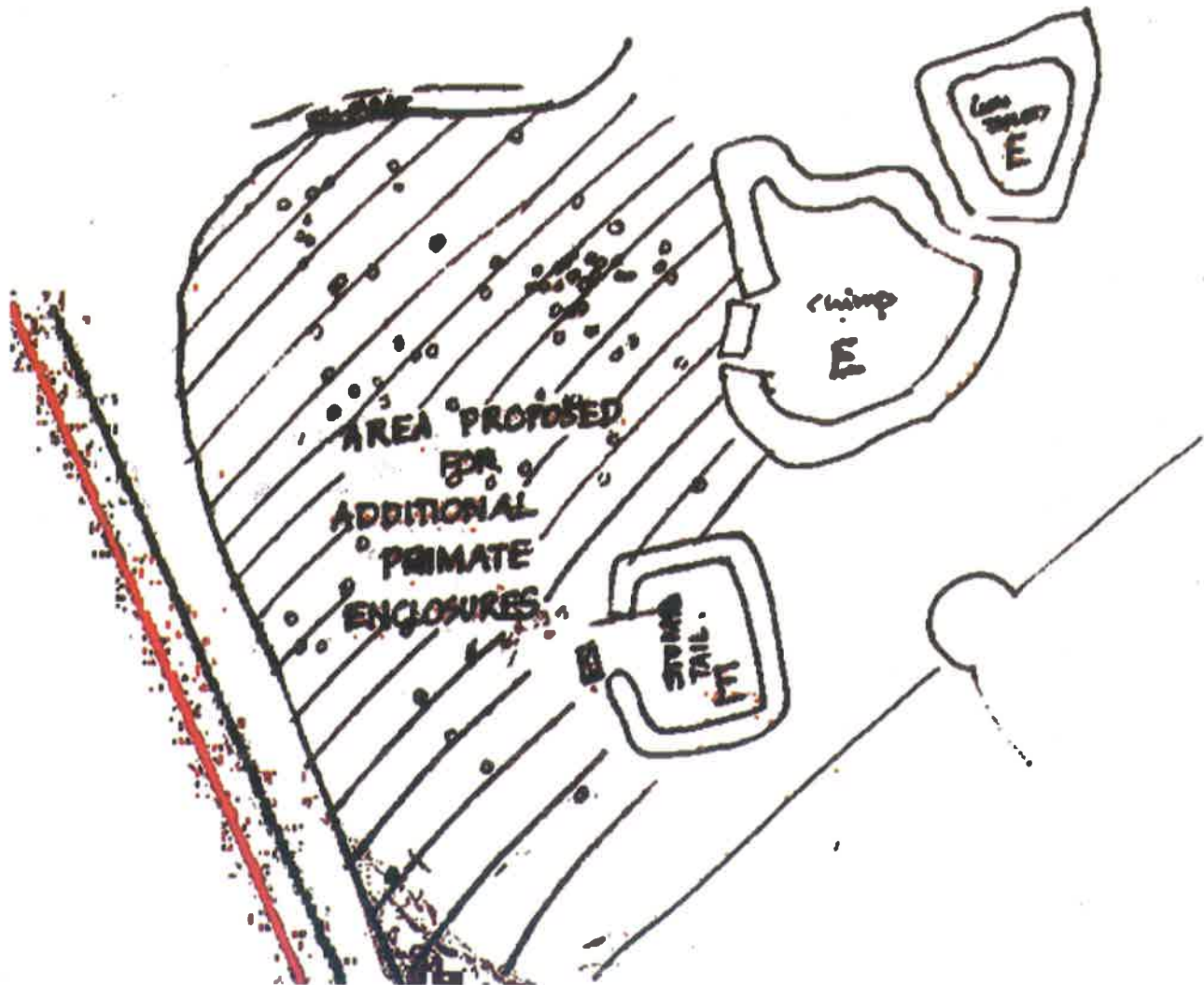
CO- ORDINATOR : Mr. Himanshu Malhotra

PARTICIPANTS : Ms.Divya Ramagopal, Sh.Manyank Methiwala , Sh.Dushyant Thaka
Ms.Lalita Gupta , Sh.Vijaya Kumar , Sh.Murlidhar Rao , Sh.Yuvraj R Kaginka ,
Sh.Manoj Kumar , Sh.Rajneesh Pandey



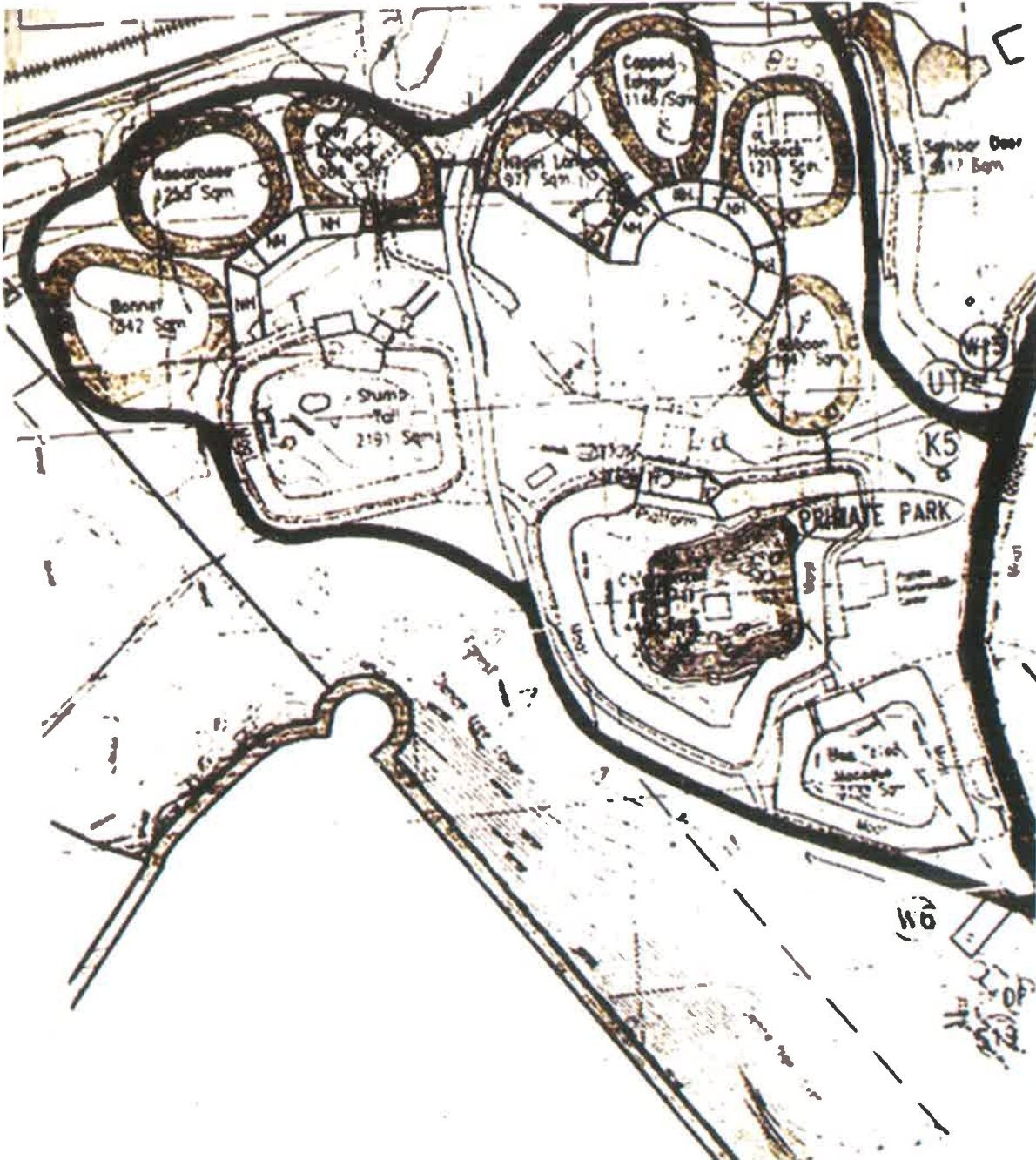
GENERAL OBSERVATIONS ON THE PROPOSED LOCATION FOR PRIMATE

- This is covered with thorny vegetation. These have to be removed and new trees (including fruit bearing trees) will have to be planted.
- The area is very close to the railway line and the boundary of the zoo which is not desirable from security and environmental point of view.
- The proposed location is very close to boundary and railway line





EXISTING PRIMATE ENCLOSURE IN NATIONAL ZOOLOGICAL PARK, DELHI





EXISTING PRIMATE ENCLOSURE IN NATIONAL ZOOLOGICAL PARK, DELHI



LIONTAILED MACAQUE



CIVIL STRUCTURES VISIBLE



BARREN LANDSCAPE



MURKY WATER IN MOAT



BLANK WALL OF MOAT VISIBLE



LACK OF ENRICHMENT

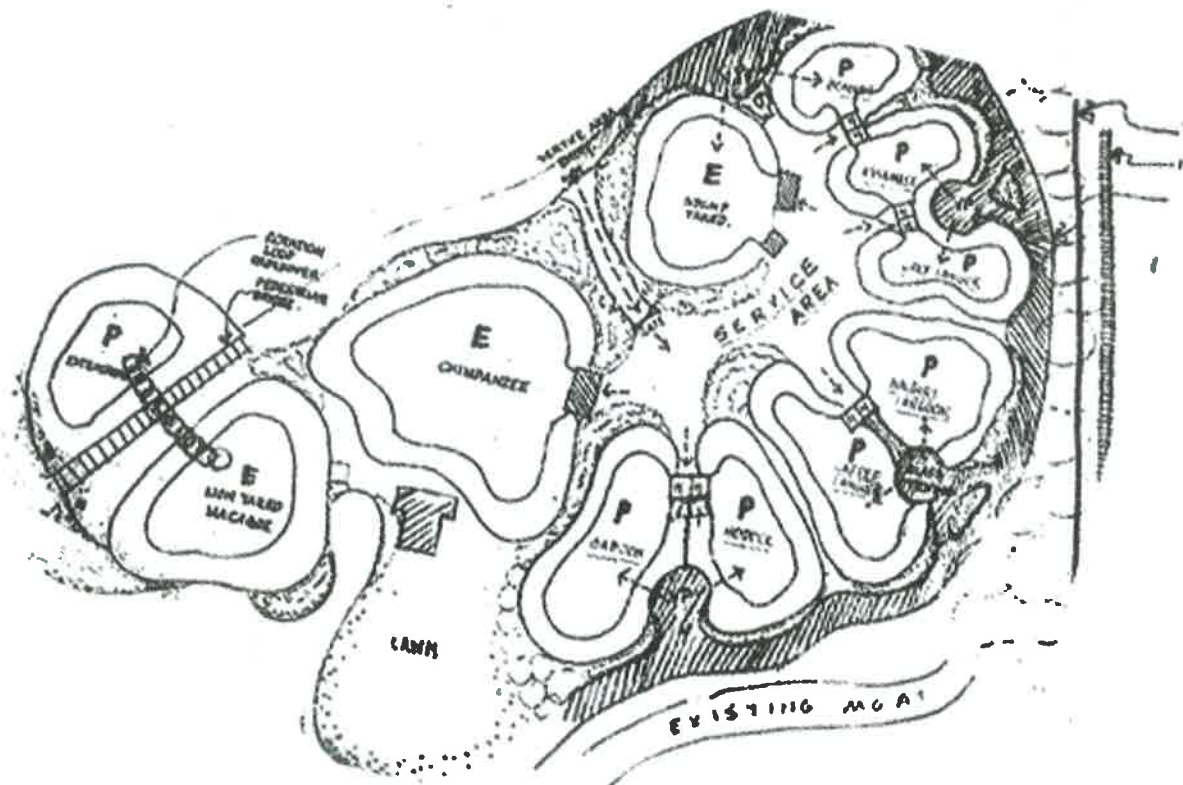


PROPOSAL - OPTION 1

VISITORS CIRCULATION FROM THE OUTER PERIPHERY OF THE PRIMATE AREA AND THE SERVICE AREA AND HOLDINGS IN THE INNER CORE

POSITIVE ASPECTS

1. All the holdings are in one location, hence making it convenient from administration and security point of view.
2. Double door security is ensured.
3. The movement of visitors is along the periphery thus trespassing of the slums adjacent to the zoo boundary will be considerably minimized.
4. Rotation of animal is possible.
5. All the existing holdings can be retained.
6. In case of any emergency or during any outbreak of diseases, only one of the viewing stand can be closed, without disturbing the visitors movement





PROPOSAL – OPTION 1

PROBLEMS IN THE PROPOSAL

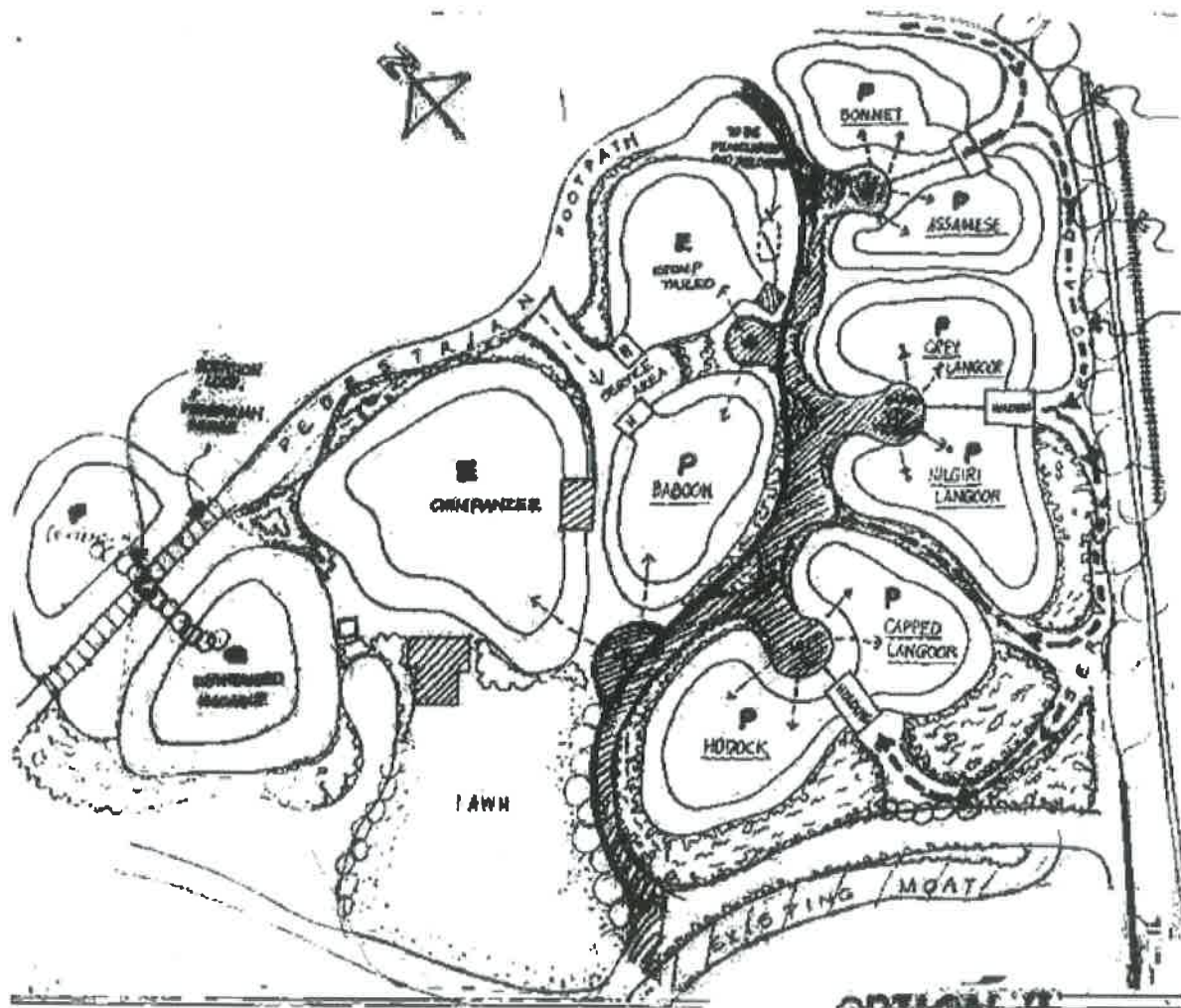
1. Viewers have to traverse a longer length for viewing all exhibits.
2. The visitors will face direct sunlight in the afternoon.

PROPOSAL - OPTION 2

VISITORS CIRCULATION FROM THE INNER CORE AND THE SERVICE AREA AND ANIMAL HOLDINGS IN THE OUTER PERIPHERY

POSITIVE ASPECTS :

1. Visitors route is shorter.
2. During afternoon , the sunrays are towards the enclosure
3. Animal rotation is possible .
4. In case of emergency , outbreak of diseases, any of the viewing stands can be closed. Yet allowing the visitors to move smoothly .



PROPOSAL – OPTION

PROBLEMS IN THE PROPOSAL

1. The holdings are distributed in four different locations creating inconvenience to the administration, security and vets.
2. Each holding has to be made individually secure
3. One of the existing holding needs to be demolished and relocated



WALK IN AVIARY



CO-ORDINATOR :



Dr. Brij Kishor Gupta, CZA

PARTICIPANTS : Ms.Parin Shah, Ms.Mehgal Arya , Sh.Ravi Chauhan ,Ms.Neelima Soni ,Sh.Ajit Kumar, Dr.Manoj Kumar , Sh.Abhishek Sharma, Sh.Gunajit Kr. Dev,Sh. Medhi , Ms.Zoya Puri, Sh. H.S. Chaudhary, Dr.Naim Akhtar , Sh.Karthikeyan, Sh.D Baskar, Sh.S.Syangden, Sh.K.L. Purohit , Sh.Mukul Jagdev , Sh.Lepzuk Jamir , Mr.Zoremsiama Khiangte



INTRODUCTION:

The team of participants working on the design proposal of the walk in aviary, started with a brief explanation of methodology followed during the study of the site and which will govern the sequence of design proposal presentation.

METHODOLOGY FOR THE DESIGN PROCESS –

Initially the team member mentioned a methodology followed for the design proposal which was as followed -

- **ANALYSIS OF THE SITE**
- **ASPECTS TO BE CONSIDERED**
- **TASKS TO BE UNDERTAKEN**
- **MESSAGE AND THEME**
- **CONCEPT**
- **THE ENCLOSURE SUGGESTIONS**
- **OPTIONS FOR THE EXPERIENCE TO BE CREATED**



SITE LOCATION –

The site is located at the rear edge of the National Zoo of Delhi. As explained, 56 % of the site is marshy area containing high water content. Site is with undulating landform and local high points and depressions.



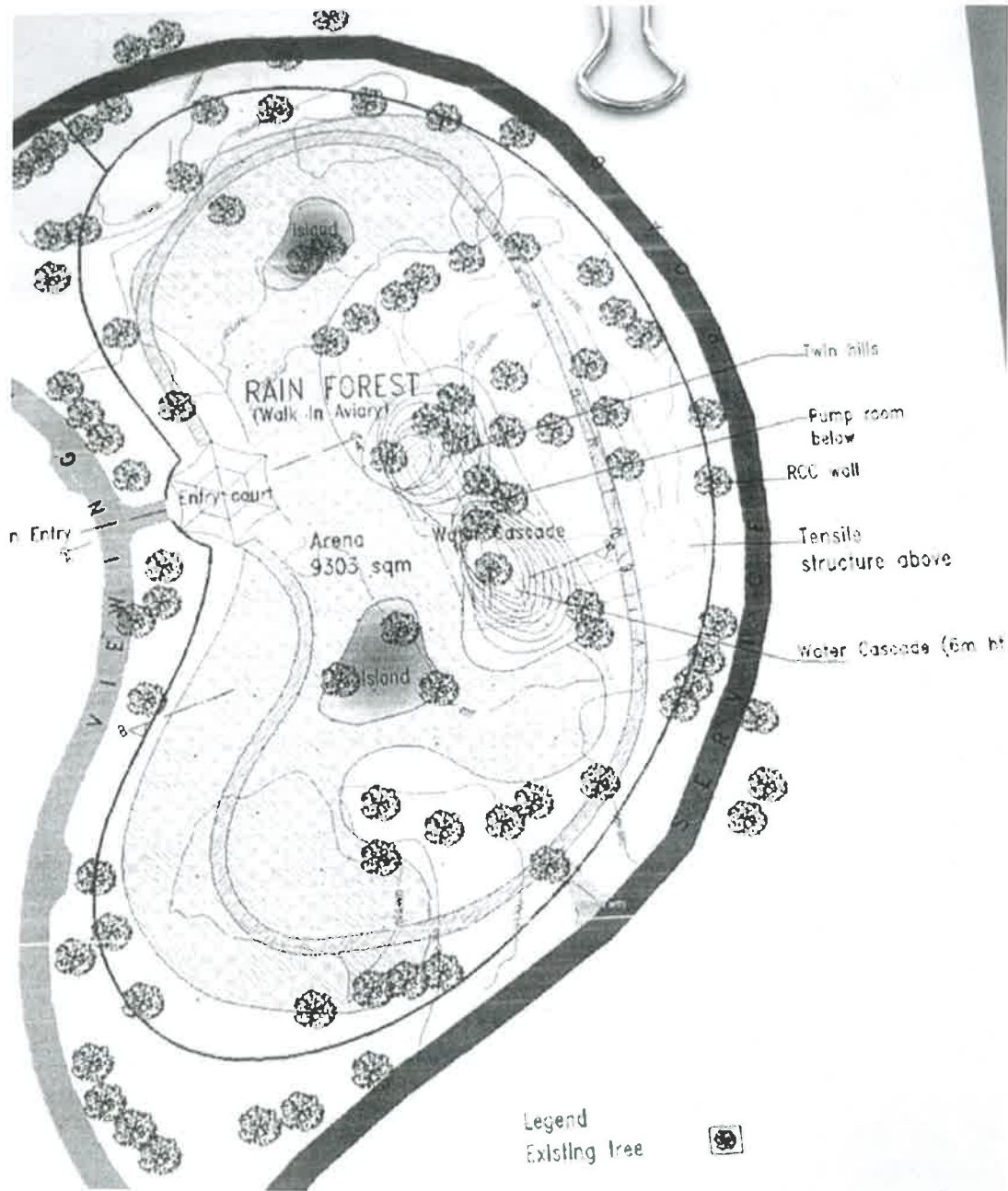


EXISTING PROPOSAL –

The proposal, which was already worked out by Central Zoo Authority, has a peripheral walk around and water body in the centre. There are two islands also designed in the water body at either ends.



The view on the site



EXISTING SITE PLAN



The service road at the rear edge of the site



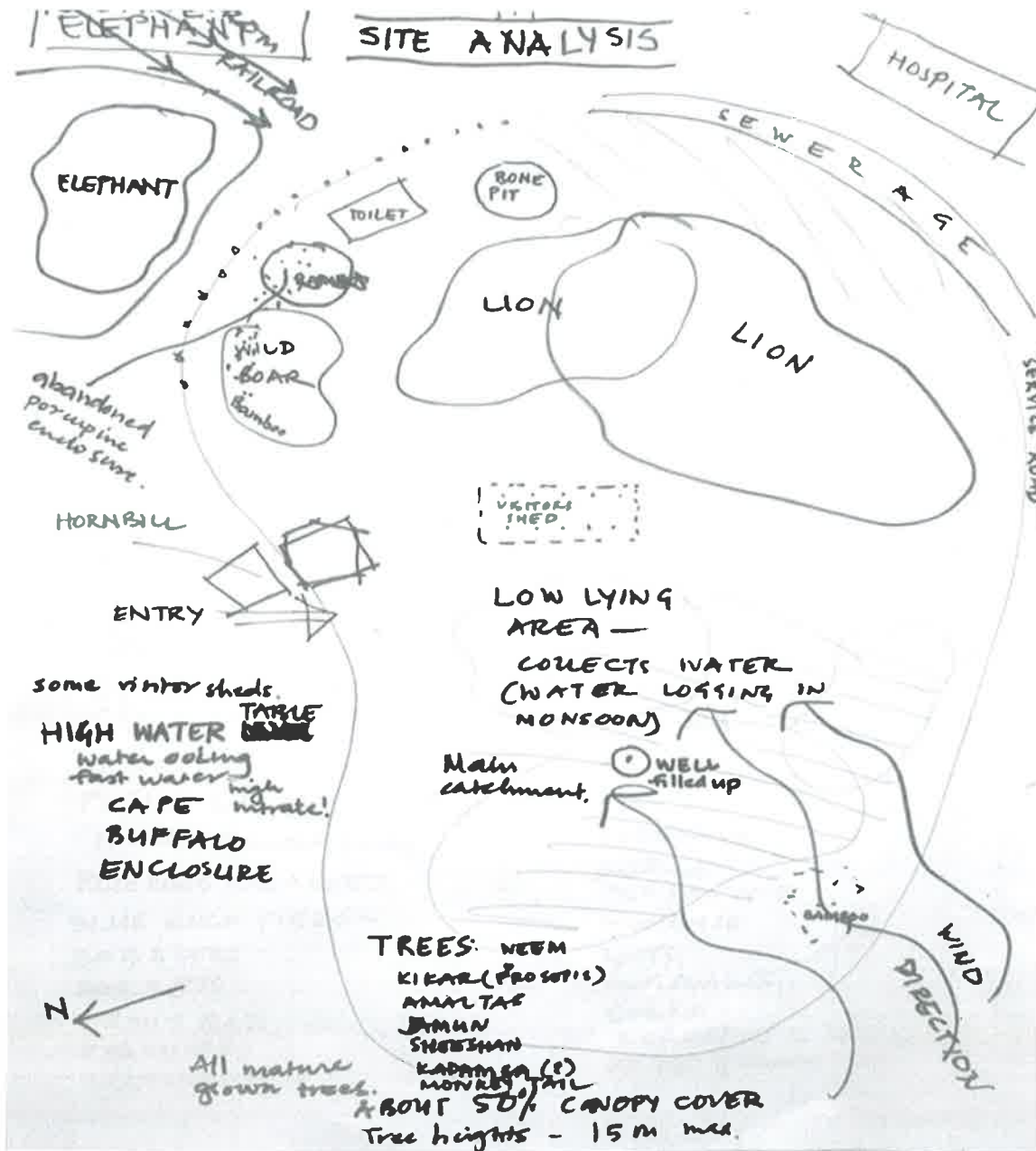
The high inundation on the site



SITE ANALYSIS -

Presently the site has lion and wild bear exhibit, toilet, an abandoned porcupine enclosure and low lying area with water logging situation.

The service road is running on the rear side of the site. The organic shape of the site with concave part facing the north have main catchment happening in the center.





SITE CONDITIONS -

AREA: 20,000 sq.m approx

- Many mature, full grown trees on site
- Site of high inundation
- Oozing from site



FREE RANGING BIRDS ON SITE

1. **Crows**
2. **Pariah Kites**
3. **Stocks-Painted Stocks**
4. **Rosering Parakeets**
5. **Blue Rock Pigeon**
6. **Babblers**
7. **Barbets**
8. **Fruit Bats**
9. **Peafowls**
10. **Grey Hoernrius**



FREE RANGING ANIMALS -

1. **Jackals**
2. **Porcupine**
3. **Ferral Cats**
4. **Mongoose**
5. **Rats**
6. **Rat Snackes**
7. **Cobra**
8. **Krates- in the bamboo**
9. **Frog and Toads**

PROPOSED SPECIES BY THE DELHI ZOO -

BIRDS

1. King Tody Flycatchers
2. Tangagers
3. Toucan sp.
4. Amazon Parrot
5. Bue Macaw
6. Military Macaw
7. Lesser sulphur crested cockatoo
8. Illiger macaw

WETLAND

- Maguari Stork

COMMENTS:

- THE SPECIES ARE MOSTLY EXOTIC AND THE AVIARY DOES NOT SEEM TO REPRESENT THE LOCAL SPECIES

RECOMMENDATION:

- The list should be inclusive of the local species



ASPECTS TO BE CONSIDERED FOR DESIGN OF AVIARY -

- Land and water ratio – to depend on species water high in present condition
- Water treatment mechanism
- Existing tree Scenario post construction
- No of trees at present – planning for trees
- Rodent free aviary
- Existing roads/ maintenance block/service road/ Swerage
- Hospital and its proximity
- Visitor Capacity
- Sound Decibels < 80 decibels
- Trees/Vegetation(Protection, removal transplantation likely to have high mortality
- Aquatic Plants to be grown
- Cut and fill for ponds?
- Extreme Temperature – may not be a rain forest aviary



THINGS TO BE DONE -

- Buffer Sound/ people movement
- Assessment of the future of the trees
- Decrease water body
- Movement path – variation of experience
- Short and long path
- Have to have compatible birds
- Deep/Shallow water bodies- variations
- Avoid cross viewing
- Separate entry /exist
- Service access
- Category of birds will dictate the design of kind of spaces

JON AND MONIKA'S COMMENTS -

- very large area big- Design in stages(better quality)
- Breeding – not compatible , special place for breeding
- Feeding cages- cage within Cage (trapping cage)– must be rodents proof
- Can have other animals- can see another animals through the mesh
- Fine netting could be of galvanized or stainless. NOTE -smaller the net greater will be the rate.
- Smaller walk trough Aviary within the Large one
- Water flow through site – Flood water with Garbage-Sluice gate.

THEME- natural immersion

MESSAGE - education

THEMATIC EXHIBITS -

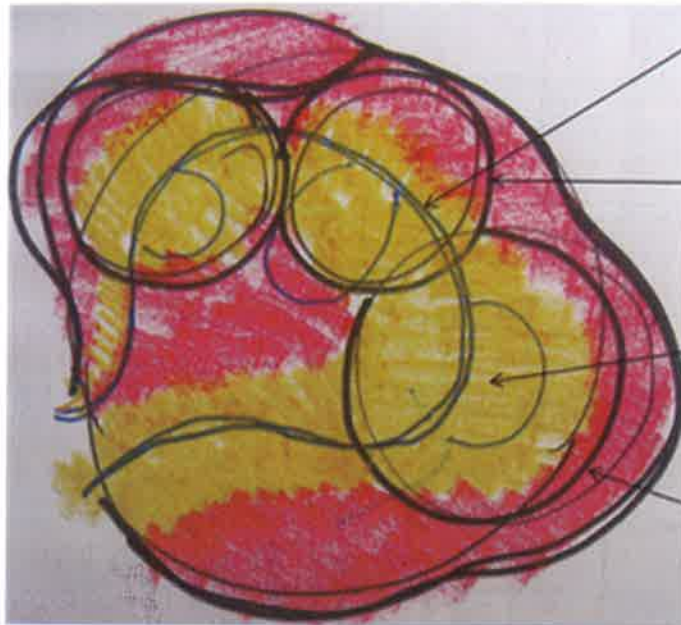
1. **Wetlands**
2. **Terrestrial**
3. **Exotic**



CONCEPTS –

Two different approaches are discussed over the conversation which were –

- a. Smaller aviary sections within a larger one
 - b. Smaller aviaries attached to larger aviary
- a. Smaller aviary sections within a larger one



Movement of people – one simple main path and smaller loops for longer, varying experiences

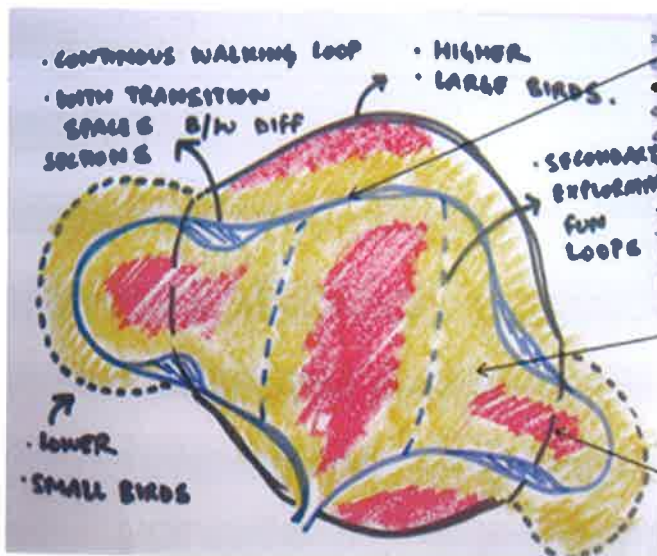
Subdivisions within the larger area

Areas visible to the people

Areas that are non-exhibit

SUB DIVISION CONNECT TO THE MESSAGE OF HAVING DIFFERENT HABITATS

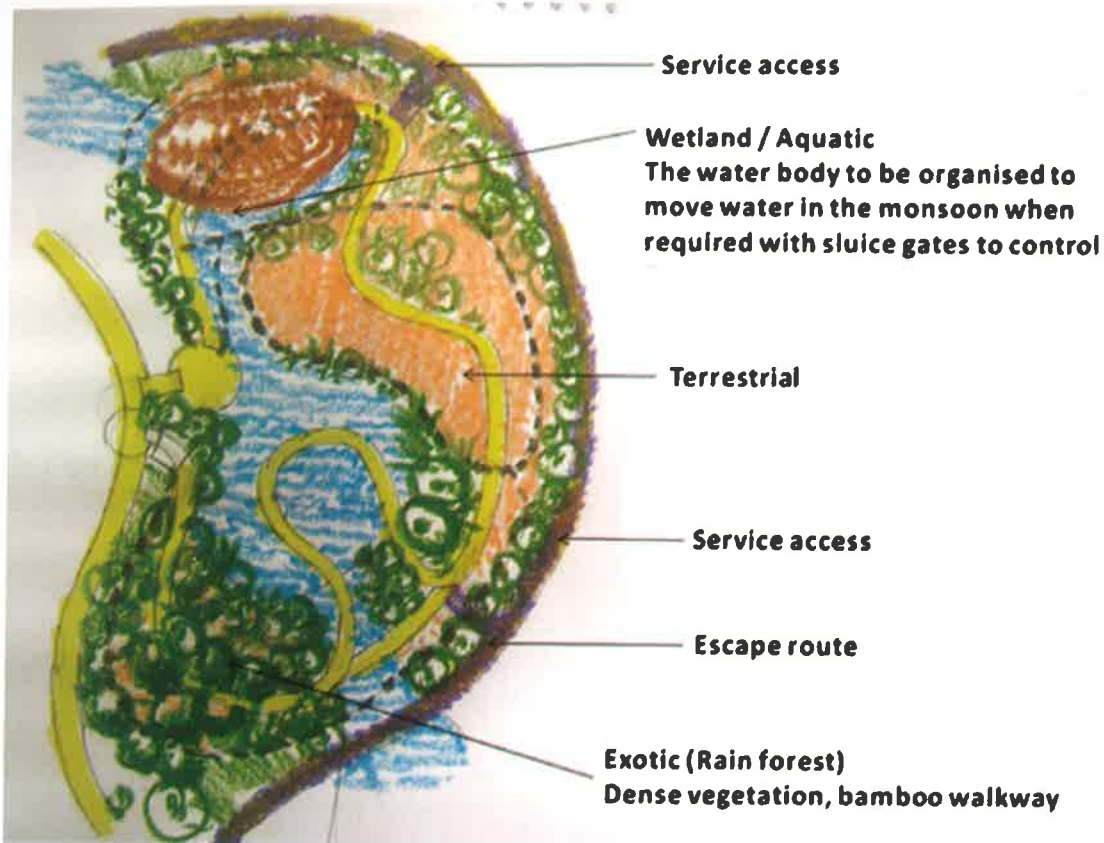
- b. Smaller aviaries attached to larger aviary-



Movement of people – one simple main path and smaller loops for longer, varying experiences

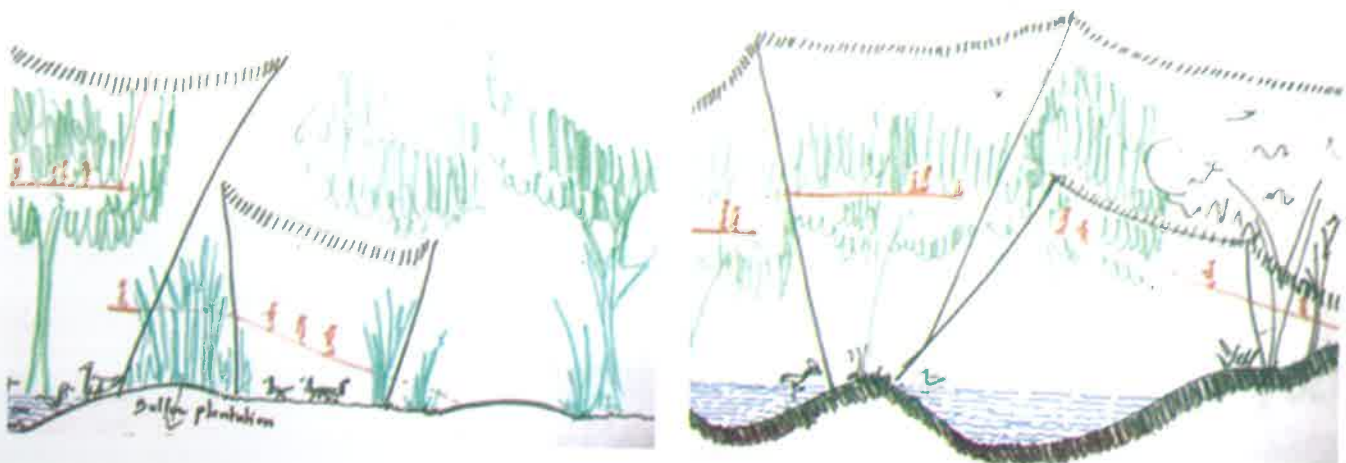
Areas visible to the people

Areas that are non-exhibit



CREATING EXPERIENCES –

The proposal includes theme which is creating different experiences while one is walking through the aviary. Visitors can see the birds from different eye-levels and different angles. The main focus of the design of walk in aviary is explained through some images and artistic views as below.





The design intension of creating walk at different levels- strengthened through 3-D views.





AMPHIBIAN EXHIBITS (PROPOSED) AT NATIONAL ZOOLOGICAL PARK, NEW DELHI



CO-ORDINATOR:



Dr. Brij Kishor Gupta

PARTICIPANTS : Sh.K. L. Purohoit, Sh. S Syandgen, Sh. Mukul Jagdev, Sh. Lepzuk Jamir, Mr. Zoresiama Kiangte, Dr. Manoj Kumar, Ms. Parin Shah, Ms. Meghal Arya, Sh. Ravi Chauhan, Ms. Neelima Soni, Sh. Abhishek Sharma, Ms. Zoya Puri, Sh. H.S. Chaudhary, Sh. Gunajit Kr Dev.

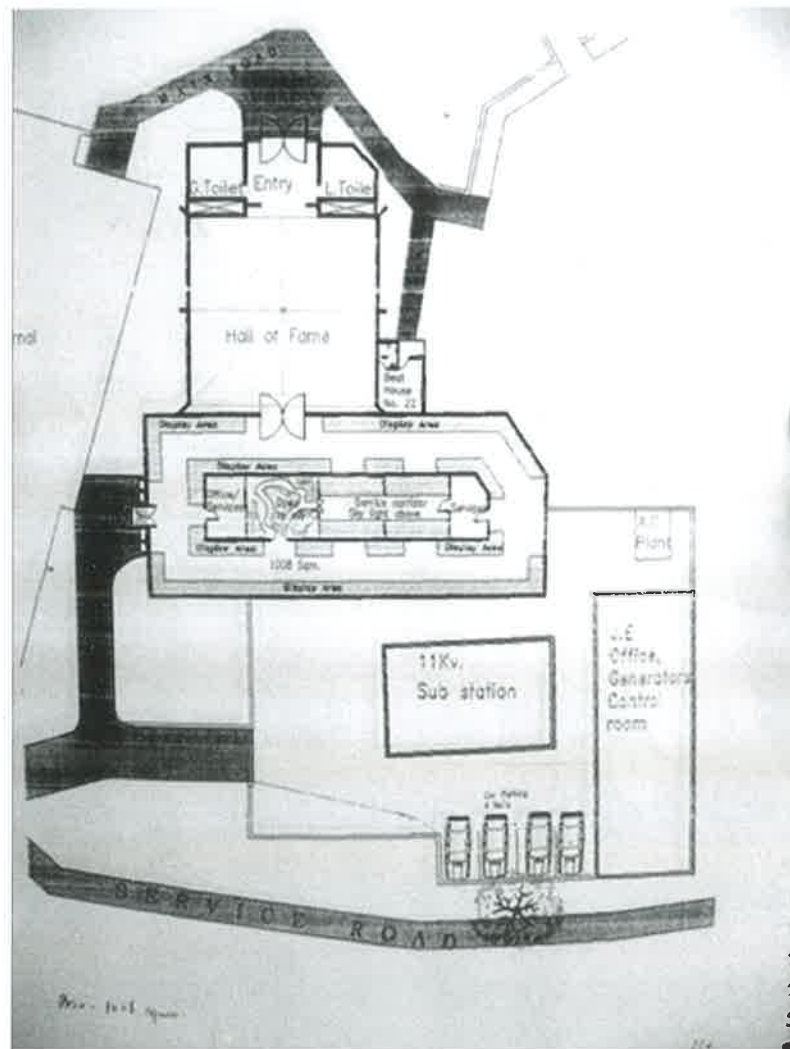


SITE CHARACTERISTICS

- No proposal yet to set up the Amphibian Exhibit
- The zoo has proposed following indoor exhibits during temperature extremes:
 - 1) Reptile House (Functional but Closed for visitors due to winter season- Hibernation issue) – Area (942 sq mts)
 - 2) Nocturnal House (Lying abandoned for last 10 yrs+) – The proposes to convert this area to Amphibian House: Area 551 sq meters
 - 3) Insectariums (New proposal) (1008 sq mts)



Guide Map



Facility Plan

MESSAGE

Where have the amphibians gone?

- Amphibian Crisis
- Amphibian conservation requires sharing of expertise and knowledge among young generation
- Partnerships of people and organisations throughout the world

Reason behind decrease in amphibian population-

- Habitat destruction (fragmentation)
- Pollution (heavy use of pesticide)
- Climate change
- Over collection (by captive facilities to feed snakes and others)

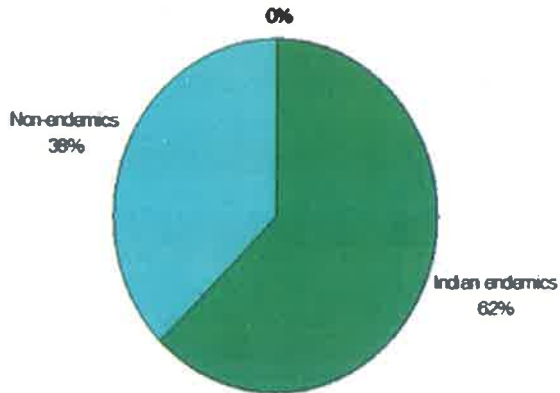


- Disease- *Chytridmycosis*
- Removal fertile/agricultural soil for making bricks and others
- Decreasing nos. of smaller ponds and wetlands areas- amphibian habitats

World Zoo and Aquarium Conservation Strategy

- Linking of zoo – wild
- Integrated approach
- Amphibian call to arms
- The global amphibian conservation response
 - Central Zoo Authority India
 - BIAZA – Working together for worldlife
 - Durrell Worldlife Conservation Trust
 - World Association of Zoos and Aquariums
 - The Amphibian Ark

Amphibians of India

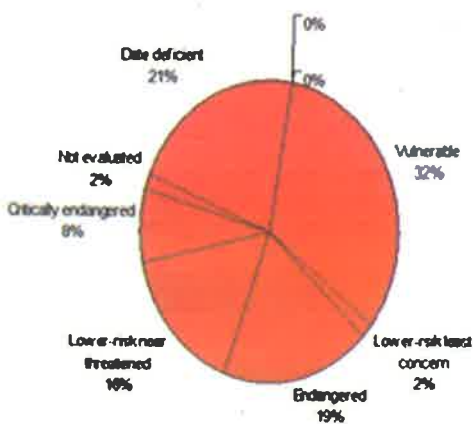


Indian endemic= 129+, Non endemic = 76+

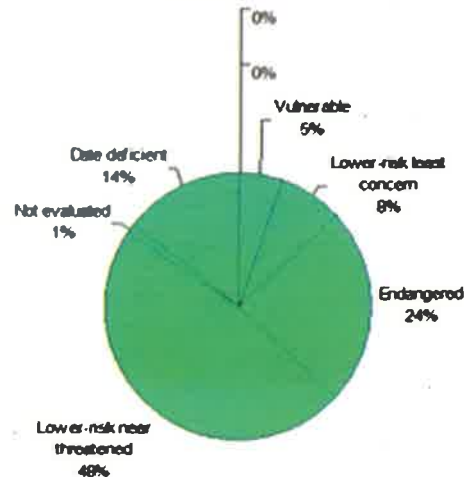
Conservation Research

Status of Amphibians in India

Endemics



Non-Endemics



Critically endangered = 10, Endangered = 24,
 Vulnerable=42, Lower risk near threatened 21,
 Lower risk least concern 2, Data deficient =
 28, Not evaluated = 2

Endangered = 18, Vulnerable=4, Lower risk near
 threatened 36, Lower risk least concern 6, Data
 deficient = 11, Not evaluated = 1

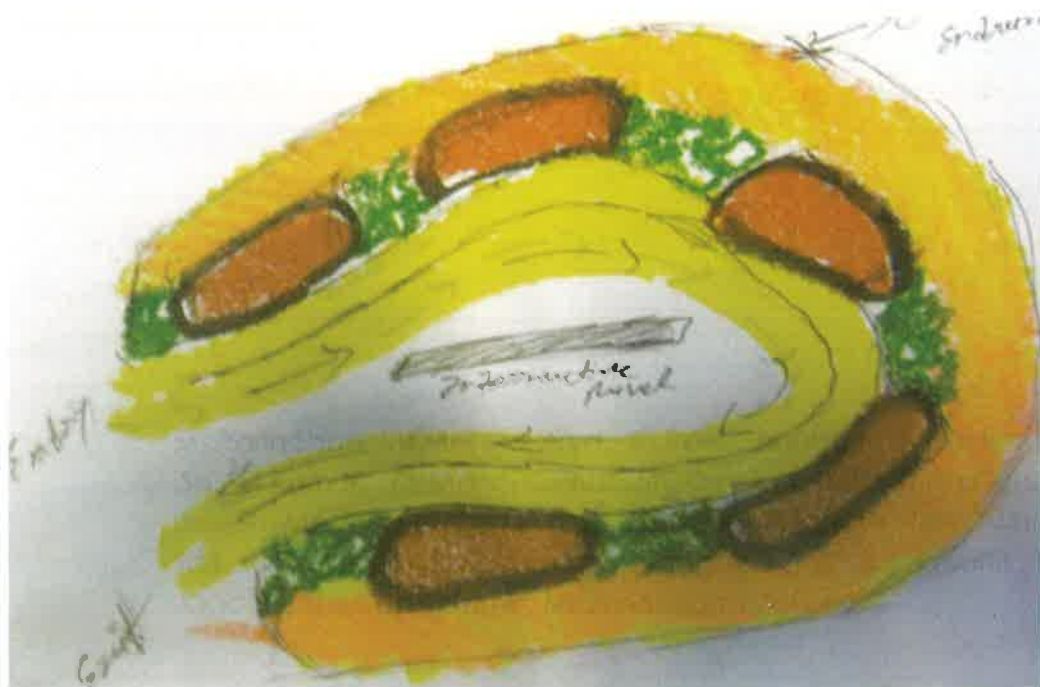


Amphibians near to extinction-

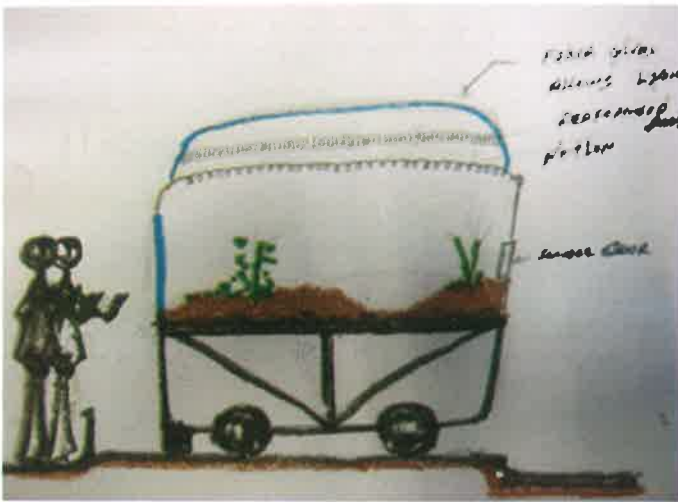
- Rana temporalis
- Bufo beddomii
- Ichthyophis beddomii
- Indirana leptodactyla
- Limnonectes rufescens
- Tomopterna rolandae
- Philatus sps
- Tomopterna breviceps
- Indirana brachytarsus
- Microhyla rubra
- Nyctibatrachus major
- Bufo parietalis
- Rana temporalis

The goal and responsibility, is to make sure that more amphibian species are not allowed to become extinct the way these did. Enough protective measures were not taken to protect the Golden Toads from Costa Rica before they were killed by chytrid fungus, or to save some of the remarkable gastric brooding frogs from disappearing.

Conservation breeding facility for Himalayan newt at P.N.Himalayan Zoological Park, Darjeeling is a step in the right direction.



Design Proposal



Amphibian Food Culture



RECOMMENDATIONS:

- 12 terrarium type indoor exhibits, which will fit in taxonomic order too – Insectariums – Amphibians- Reptiles.
- Low cost structure, using local material
- Start in phase manner, in first phase may start with 4 species only
- The facility should have independent technical/scientific staff, being specialized facility.
- To house only commoner species available locally.
- Standardize protocols for housing the species
- Should have independent water filtration system
- Area for rearing tadpoles and young ones
- Area for rearing feed
- Area for interpretation/education.

RESOURCES

Book:

- Captive care of common Indian frogs and toads, 1998. Published by Coimbatore Zoological Park and Conservation Centre. 27pp.

Research Papers:

- Brij Kishor Gupta, 1998. Captive management and breeding of the Verrucose frog *Limnocharis keralensis*. International Zoo News, Vol.45/7, No. 288. 427-430.
- Brij Kishor Gupta, 1998. Breeding of Large wrinkled frog *Nyctibatrachus major* at Coimbatore Zoo. Solitaire, No.6, 4-5.
- Brij Kishor Gupta, 1998. On Reproduction and Captive Breeding of –Ranids, Journal of Animal Keepers' Forum, Vol. 35, No.12, pp. 464-465.
- Brij Kishor Gupta, 1998. Declining amphibians. Current Science, 25 July 1998, Vol. 75, No.2. pp 81-84.
- Brij Kishor Gupta, 1997. About Frogs - The Amphibians. between-us, A Magazine of Freelance Journalists Association, Oct-Nov. 1997, pp. 19-21.
- Brij Kishor Gupta, 1998. Rearing crickets at Coimbatore Zoo. Insect Environ, Vol. 4.
- Brij Kishor Gupta,, 1997. The Amphibians. Kalaikathir, A Scientific Tamil Monthly, December 1997, pp. 47-49.

Pictorial glimpse of Day 3





Intimate moments by:

Mr. Jon Coe

Australia



Thank you all for this wonderful experience. These trips are never disappointing for me, the entire feeling and hospitality was very appealing.

The zoo that is looked upon as a great zoo has gone through hard times. All zoos have undergone a change and the change is for the better. We are hoping that fifty years from now there won't be any boundaries between zoos and the natural world.

Zoos are great stepping stones towards betterment. People, who are working in zoos, work from their heart. There is a great opportunity in zoos, you need to grab this opportunities. When you all know you all have the wisdom and skills, you should take it forward. Here is a good chance.

Wish you luck.



Intimate moments by:

Ms. Monica Fiby

Zoolex, Austria



Due to interactive sessions in various parts of the world, we understand how important role a zoo can play in a city. A zoo can be a tool to understand biodiversity of a place.

When I went to Zoolex, John was very inspiring. Principles of design of zoo planning should be important document not only for design but also for policy making. Zoo gives us great opportunity to get to interesting people and to learn about Indian zoos. It also gives great opportunity to work on natural exhibits. With this enthusiasm and spirit, the outcome is quite serious.

Thank you all, and thank you wonderful students. Working under pressure and always giving us a better opportunity. Team work is the key to success. Hope to see you again. Keep in touch.



Intimate moments by:

Mr. B.S. Bonal

Member Secretary, CZA



Let me extend my heartiest thanks to John and Monika. Hyderabad's workshop was conducted on similar subject. Delhi zoo you have to request C.C.U. to design the zoo. It was there we realised that it is half done or not done unless you involve the person in the field. For that there would have been no better institute than SPA.

I thank Prof. Dr. Surinder Suneja who readily agreed to conduct this convention. I thank the director and the students for the same. A special thanks to S.C. Sharmaji, he was the member of CZA. He is the man of the past but wants a better future for zoos. After this convention I want to see Delhi zoo with a new design and new concept.

So far SPA has been a centre of excellence and CZA is always there for a helping hand. We look upon you for your support. Let's hope that we'll meet again.

Thank you



Intimate moments by:

Mr. Amitabh Agnihotri,

Director, National Zoological Park, New Delhi



This convention is an excellent platform where we can have linkages between professionals and government officials. Recently we are putting up a centre for disaster management. These are emerging areas and it is important to bring in people together.

I am thankful to CZA members for this idea and vision. We are emerging as one important nation and this should not be the last step. We need such programmes to build bridges where we can continue to work together.

I thank Prof. Dr. Surinder Suneja and the students for their support and enthusiasm. I am grateful to experts from different continents for sharing their knowledge. I once again thank Mr. Bonal and Mr. Sharma. I thank all of you to make this programme a great success.



Intimate moments by:

Mr S. C. Sharma

Founder, Member Secretary, CZA



This has been one of the best workshops I have ever attended. I thank you Prof. Dr. Surinder Suneja for taking this initiative. The professional manner in which this workshop has been conducted is unique. I am thankful to the Director and the Dean, without their support this would not have been possible also to Mr. Bonal for his thoughts on this workshop.

I request all the participants; let this not be a concluding workshop. Try to implement these things on the ground. It is important that Zoo managers start thinking how to intercept the changes. Sometimes zoo situations are helpless. I have requested Mr. Bonal to involve policy level people and highlight the problems.

Timely interception and planning is more important than team work. This workshop has created a hope for a new dawn that zoos are respected by the people. Unless we get the support, it is hard to meet the expectations. Time is short and I wish to see the changes in my lifetime.



Intimate moments by:

Prof. Dr. Surinder Suneja

Course –Co-ordinator,SPA, New Delhi



It is a part of our responsibility to designate our knowledge. Let me thank Mr. Bonal for entrusting us with this responsibility.

I am grateful to the Indian Habitat Centre for providing great ambience for this workshop. I thank all the students for their hard work and support and for making this workshop possible. Thank you all the delegates from all parts of the country for their participation and contribution.

I hope all this is demonstrated whatever we have learnt and is put up in practice.

Thank you



LIST OF SPEAKERS

1. **Mr. B.S. Bonal**
Member Secretary, CZA
2. **Dr. Brij Kishor Gupta**
EMO. CZA
3. **Mr. Jon Coe**
Australia
4. **Ms. Monika Fiby**
Zoolex, Austria
5. **Mr. S.C. Sharma**
Founder, Member Secretary, CZA
6. **Mr. S.K. Patnaik**
Member, CZA
7. **Prof. Dr. Rommel Mehta**
8. **Prof. Dr. Meenakshi Dhote**
9. **Mr. Amitabh Agnihotri**
Director, National Zoological Park, New Delhi

LIST OF PARTICIPANTS

1. K. L. Purohoit
2. S Syandgen
3. Mukul Jagdev
4. Lepzuk Jamir
5. Zoresiama Khiangte
6. Manoj Kumar
7. Parin Shah
8. Meghal Arya
9. Ravi Chauhan
10. Neelima Soni
11. Abhishek Sharma
12. Zoya Puri
13. H.S.Chaudhary
14. Gunakit Kr Dev
15. Divya Ramagopal
16. Manyank Methiwala
17. Dushyant Thakar
18. Lalita Gupta
19. Vijaya Kumar
20. Murlidhar Rao
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29. Manoj Kumar
30. Abhishek Sharma
31. Gunajit Kr. Dev
32. Medhi
33. Zoya Puri
34. H.S. Chaudhary
35. Naim Akhtar
36. Karthikeyan,
37. D Baskar
38. S.Syangden
39. K.L. Purohit
40. Mukul Jagdev
41. Lepzuk Jamir ,
42. Zoremsiama Khiangte
43. Rakesh Kumar
44. S. K. Ghatraj
45. Savita Punde
46. Riaz Ahamad Khan
47. G.N. Chitari
48. Raj Kumar
49. Pankaj Jain
50. Moin Ahemad
51. G.M. Dangat
52. D.H. Borawake