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# ENVIRONMENT & EDUCATION:

The Development of an Outdoor  
Experiential Learning Centre for  
the Manitoba Children's Museum

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A practicum presented to the University of Manitoba  
in partial fulfillment of the requirements of the degree  
Master of Landscape Architecture

BY

DONNA G. BEATON

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**ENVIRONMENT & EDUCATION:  
THE DEVELOPMENT OF AN OUTDOOR EXPERIENTIAL LEARNING CENTRE  
FOR THE MANITOBA CHILDREN'S MUSEUM**

**BY**

**DONNA G. BEATON**

**A Thesis/Practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial  
fulfillment of the requirements for the degree of**

**MASTER OF LANDSCAPE ARCHITECTURE**

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## Abstract

This practicum identifies and examines issues involved in designing an outdoor learning center to provide a hands on, interactive experience through which children ages three to twelve can begin to develop environmental literacy; particularly in the area of natural and man-made systems. A children's museum environment is used as the medium through which the outdoor learning center operates.

The study begins with an introduction to the subject, followed by an extensive theoretical review of child development and learning styles; how children come to learn about their environment, and the role and processes through which children's museums facilitate child development and environmental education.

The study then focuses on the application of the theoretical knowledge to the development of strategies and design principles to guide the conceptual design of an outdoor learning center at the Manitoba Children's Museum, located on the grounds of the Forks Development in Winnipeg. The outdoor learning center incorporates several interactive exhibits demonstrating the natural and man-made systems comprising the hydrologic or water cycle.

A concept plan demonstrating the translation of the design principles into form is included, as well as several drawings illustrating the various exhibits comprising the learning center. A proposed education framework relating the exhibits to child development and learning style theory is also outlined.



## Acknowledgements

The completion of this practicum has been a long time coming, and many friends have had an invaluable role in seeing me through it:

Special thanks are extended to Joy & Kirby for 'everything' you've done for me over the years, it has meant alot knowing you are always there.

To Doug, Patti, Jonina, Mary, John , CJ, Shauna and Diane who's critiques, coffee chats, kick starts and the remarkable edits of the early drafts helped give structure and coherence to the project, and life in general. Many, many thanks.

To the Nobiss's, Nancy & John, Carrie, Carla, the Gorings, and my family for always being there to lend a hand, keep me fed, and lift my spirits. I couldn't have made it without you.

And, to Jim, Curt, Bruce and the gang at work, my heartfelt thanks for your encouragement, support and warped sense of humor. You, indeed, make every day a treat.

Finally, to my committee, chaired by Professor Charlie Thomsen and assisted by Mr. Jeff Frank and Professor Carl Nelson. Your guidance, accommodating schedules, remarkable patience, and endurance will be forever appreciated.

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## Chapter 1.0

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# INTRODUCTION

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*If you are thinking a year ahead, sow a seed.  
If you are thinking 10 years head, plant a tree.  
If you are thinking 100 years ahead, educate the people.  
- Chinese poet, 500 B.C.<sup>1</sup>*

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<sup>1</sup> Environment Education Advisory Committee to the Environment Council of Alberta. EE 2000 Environmental Education for Sustainable Future. Alberta: Environment Council of Alberta 1989. p.6.

This study was inspired by the questions; "What situations and experiences would aid in the development of environmental literacy in children?" and "How might these experiences be incorporated into an outdoor learning center?" These represent an exploration of both an educational approach and a specific learning style which serve as a basis for the development of an outdoor environmental learning space for a children's museum.

The theme for this study evolved from an expressed need for public education about the environment, specifically referring to systems which operate around us. The children's museum was identified as an opportune venue for environmental learning because of its unique educational philosophy which stresses developmentally appropriate and sensory enriched contexts for learning, but also because of the wide spread audience that they attract. Any hopes of ensuring a future directed by ecologically sound actions and decision making, necessitates that society, as a whole, adopt modified attitudes and lifestyles. An increased understanding of natural and man-made systems, and man's place within them, was used to determine programmatic requirements and site layout.

Design issues such as environmental education, child development, and specific learning needs, were summarized and used to identify strategies for the conceptual design for an outdoor experiential learning center. The space identified for this project is the Manitoba Children's Museum's new site at the Forks.

This practicum report is organized into two parts. Part A provides a summary of child development and learning; environmental education; stimulation of environmental responsibility; and design criteria for exhibits within children's museums. Part B deals with the site specifics of a proposed outdoor exhibit for the Manitoba Children's Museum, the proposed education framework, development of the exhibit concept, and conceptual design.

## **Design & Education**

Landscape architects have a role in environmental education. There is an opportunity to promote greater environmental understanding by proposing and supporting ecologically responsible landscape practices, or landscape architects can take an active role in the establishment of learning environments.

Effective environmental education should provide a general understanding of basic concepts that inspires one to continually ask the questions *why* and *how*, and in the

process to seek out new solutions to the ever present environmental problems. It should also provide people with the knowledge to enable them to think and act for themselves.

From a programmatic perspective the outdoor learning space proposed by this practicum is not a "how to" lesson prescribing 'right' or 'wrong' actions. Instead it provides a framework from which to explain and draw analogies to the basic concepts of environmental systems. It is intended to illustrate man's ability to impact both positively and negatively on natural processes. From a design perspective it recognizes that the context for learning provides a powerful influence on how and what children learn. Design must develop from a sensitivity to both the physical and psychological appearance of the surroundings. Colours, lighting and texture all contribute to kinesthetic and sensory awareness. The total visual, spatial, auditory and psychological messages that children receive from their environment are integral design considerations.

### **Environmental Education**

Environmental education, in its simplest form, is about helping people understand the interconnected nature of the planet, and their place in it. It recognizes that actions have ramifications, and the lack of consideration for our affect on the environment has led to some of the most deplorable conditions in the world today. The goal of environmental education is to encourage people to take responsibility for their actions in order that they will act responsibly and sensitively towards the environment.

Participation in environmental learning is based on a philosophy which stresses individualized experiential learning. People naturally want to touch and interact with things.

Studies indicate that knowledge is best acquired when it is provided in positive, non-threatening ways.<sup>2</sup> Much of the negative media coverage about the state of the environment, paints a grim picture that can lead to disillusionment and feelings of helplessness and inadequacy. People require positive experiences and messages to motivate change of action, attitude and to nurture learning potential.

Environmental education combines facts, as well as impressions, emotions, and feelings. People only become fully responsible in caring for and protecting the environment if they possess both knowledge and feeling.

---

<sup>2</sup> Lisa Bardwell, "Success Stories, Imagery by Example." *Journal of Environmental Education*, Vol. , No. 19, pp. 5- 15.



While it is generally agreed that the best time to begin teaching people about issues of the environment is when they are young and most impressionable, it is also becoming painfully clear that we cannot sit back and wait until these future decision makers are old enough to save the planet. We do not have the luxury to wait for these children to mature. It's their parents who are the present stewards of tomorrow's environment and will determine the quality of the environment that will be passed down. "If children are in fact a key audience, then they must make use of their newly acquired environmental knowledge to exert a profound influence on their parent's environmental attitudes and behavior."<sup>3</sup> Sutherland & Ham recommend that more emphasis be placed on non-formal environmental education programs that target adults (particularly ones that are non-confrontational and fun), and not to assume that adults are routinely reached by information presented to their children. (Sutherland and Ham, 1992)

One of the hardest things to convey to the individual is nature's complex interconnectivity - the delicately balanced natural systems and cycles that make life on this planet possible. To begin to understand a natural system one must understand their place and impact within that system.

### **Natural and Man-made Systems**

The environment is a complex interplay of cycles; the water cycle, the air cycle and the mineral or soil cycle. (Savan, 1991) We are just beginning to understand how interconnected the various parts of the world are and how an impact on one area can have an impact elsewhere. Cycles work because there is a constant and equal flow in and out. What is used becomes replenished. Plants grow and die only to replenish the soil beneath them with nutrients or spread seeds to initiate the cycle all over again. Once this cycle becomes off balance the whole system starts to falter.

Next to the air we breathe and the soil that we live upon, water constitutes our most precious resource. Covering more than 2/3 of the earth's surface, water is present both directly and indirectly in every aspect of our lives and is indispensable to all living organisms. Life as we know it is impossible without water.

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3 David S. Sutherland and Sam H. Ham, "Child-to-Parent Transfer of Environmental Ideology in Costa Rican Families: An Ethnographic Case Study," *Journal of Environmental Education*, 1992, Vol. 23, No. 3, p. 10.

No matter how sophisticated our man-made systems become, we will always rely on natural systems. While we try to mimic the natural systems, we can never improve or replace them. It is for this reason we must understand the potential impacts and recognize where damage can occur.

The specific environmental system selected for the proposed outdoor exhibit is the 'Water Cycle'. This was chosen because of the many facets of the cycle that occur both naturally and as modified by man. The exhibit is comprised of several components of the water cycle, each of which could stand alone in a children's museum setting. The components have been arranged in a representative place in the cycle to demonstrate the entire, interrelated system.

### **The Children's Museum - An Opportunity**

Similar to science and history museums, many youth museums are dealing with global issues and addressing concerns of the environment through special exhibits. While many indoor settings present children with a wonderfully simulated experience, nothing can replace actual encounters in the natural environment. With the relocation of the Manitoba Children's Museum to the Forks, the facility now has an potential to establish an outdoor exhibit space. This site provides an excellent opportunity to extend experiences from within the museum out into the surrounding landscape.

The educational philosophy of children's museums is in keeping with some of the basic notions of environmental education by questioning the way we live. Through specially developed exhibits, galleries and displays, children's museums encourage an exploration of *why* and *how* we do the things we do. The concept of a children's museum is that of an experiential, alternative learning environment that fosters the idea of discovery through hands-on interaction and developmentally appropriate participation. Though geared primarily towards child development and learning, children's museums also promote shared learning experiences. Parents, grandparents and care givers are encouraged to become involved in the child's learning process. For the involved adult learner, the museum may re-ignite or re-kindle misplaced curiosity, making them equally open to explore and learn with their children. This is an important factor for instilling environmental literacy to a broad population base.

## Goals & Objectives

This project is about environmental education. Specifically, it is about experiential learning typified by children's museums and applied to an outdoor setting. It investigates the planning and design of an experiential learning center, to enhance peoples understanding and awareness of environmental systems.

The goal of this project is to create a learning experience that promotes environmental literacy. Recognizing the inextricable link between the content and the context, this project goes beyond the standard planning of a landscape-related project by recommending content and ideology in the form of an educational program.

The objectives of this project are two fold: 1) to identify design issues and strategies in the creation of an outdoor environmental space for children to learn, through experience, the relationship between natural and man-made systems and 2) to develop a conceptual design for an outdoor experiential learning center for the Manitoba Children's Museum at the Forks, that focuses on environmental systems and cycles, based on the following criteria:

1. that the permanent outdoor learning center be created for children that:
  - a) is developmentally appropriate for children ages five to ten, and
  - b) encourages self-directed exploration and discovery in a fun, non-confrontational way.
2. that the context for educational experience be positive and non-prescriptive.
3. that children be provided the opportunity to understand and be more aware of both:
  - a) *their* relationship with man-made and natural systems, and,
  - b) the impact man-made systems have on natural environments.
4. that shared learning be promoted through:
  - a) inter-generational exchanges (parent/adult - child communication),
  - b) cooperative learning (activities that necessitate two or more participants).

## Methodology

The steps taken to achieve the objectives were as follows:

1. Identify and describe the relationship between design, education and the environment.
2. Conduct a literature review of the central themes: environment, learning, and child development,
3. Conduct interviews with experts in the fields identified above to supplement the literature review,
4. Identify pertinent design issues,
5. Establish design strategies,
6. Identify and describe the context for applying these strategies in a conceptual design,
7. Identify key concepts to serve as a framework for the development of an educational learning center.
8. Develop a conceptual design for an outdoor water system at the Manitoba Children's Museum.

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*PART A*

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## Chapter - 2.0

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# **BACKGROUND:** *Children, Learning, the Environment & Museums*

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*"The Purpose of life, after all, is to live it, to taste experience to the utmost,  
to reach out eagerly and without fear for newer and richer experiences" <sup>1</sup>*

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<sup>1</sup> Eleanor Roosevelt as quoted in The Wonder of It: Exploring How the World Works. Edited by Bonnie Neugebauer. Redmond, WA.: Exchange Press Inc. 1989., p 6.

This section provides a description of the primary user, the educational philosophy of experiential learning, the context for learning in a children's museum setting and the processes of educating people about the environment. This forms the framework for the educational focus and the program, and provides a foundation for identifying the issues and establishing strategies for the design development. The description which follows is further supplemented by the documentation compiled in Appendix A - Characteristics of Children.

## 2.1 CHILD DEVELOPMENT

Childhood is a critical period in human development: physically, emotionally, intellectually and socially. Many of the attitudes and values that are developed during these critical years will shape individuals for life. Therefore attempts to educate today's child should consider the ways in which children come to understand themselves and *their* world. This means understanding how children process information and realizing the importance of providing content and settings that respect their changing abilities.

The study of child development and educational psychology began with the realization that children's perceptions and abilities differ from adults. Adults rarely see the world through the same magic lens of a child's eyes. Young children live continuously in the



FIGURE 1: Child's Eyes - ever attentive, seeking out new experiences  
(Source: Lorie, p.78)

here and now of experience; feasting upon nuances of color, light, sound, odor, and touch, unencumbered by adult demands to pursue goals, use time well, or respond to someone else's expectations. Their responses to the environment are immediate and inseparable from the sources of stimulation around them; having limited experiences in the world they are not influenced by preconceived notions or biases. Understanding is an unending process fueled by curiosity and discovery; as such, new experiences are attacked with earnest. For a child almost every experience is new, therefore learning takes place all the time. This is not to say that learning stops as one ages, but the zeal and enthusiasm with which children face new experiences, is unparalleled.

This summary looks at the general needs of children with respect to learning and development. It is based on the assertion that in order to ensure that the project content and approach is relevant, one must understand the needs, abilities and limitations of the user. Its aim is to provide a working, although rudimentary, knowledge of children to serve as a basis for designing a learning environment that is developmentally appropriate for the primary audience.

### **Stage Theories and Developmental Appropriateness**

Within human development are two dimensions that determine developmental appropriateness: one relating to age and the other to individuality. Age appropriateness recognizes that there are progressive and sequential periods of growth and change that occur in children during their first nine years. These universally predictable changes occur in all domains of development - physical, social, emotional, and cognitive - and are loosely linked to chronological age. Individual appropriateness is less predictable, acknowledging that each child is a unique person with an individual pattern and timing of growth, as well as individual personality, learning style, interests and background (Bredenkamp, 1987).

The notion of developmental appropriateness (age appropriate learning) is supported by the theories of Jean Piaget, a noted child psychologist. Piaget's theories about how children think, and particularly about stages in the development of their thinking, have been a strong basis for curriculum development.

Piaget's Preoperational and Concrete Operational Stages correspond to the 2 - 12 year age group that most children's museums, including the Manitoba Children's Museum, cater to. The following provides a summary of the developmental characteristics of the Preoperational and the Concrete-operational child with respect to learning about the environment. (A detailed table outlining the characteristics of these stages is included in Appendix A.)



### *Characteristics of the Preoperational Child*

The period from age two to seven is usually referred to as preschool or early childhood and is characterized by the importance of play. While play occurs at all ages this age group is the most playful, spending most of their time engaged in play activities. Bodies develop as they chase and dare, minds develop as they play with words and ideas, and social skills and moral rules are acquired as they play games and dramatize fantasies. "In the process they acquire skills, ideas and values that are crucial for growing up".<sup>2</sup>

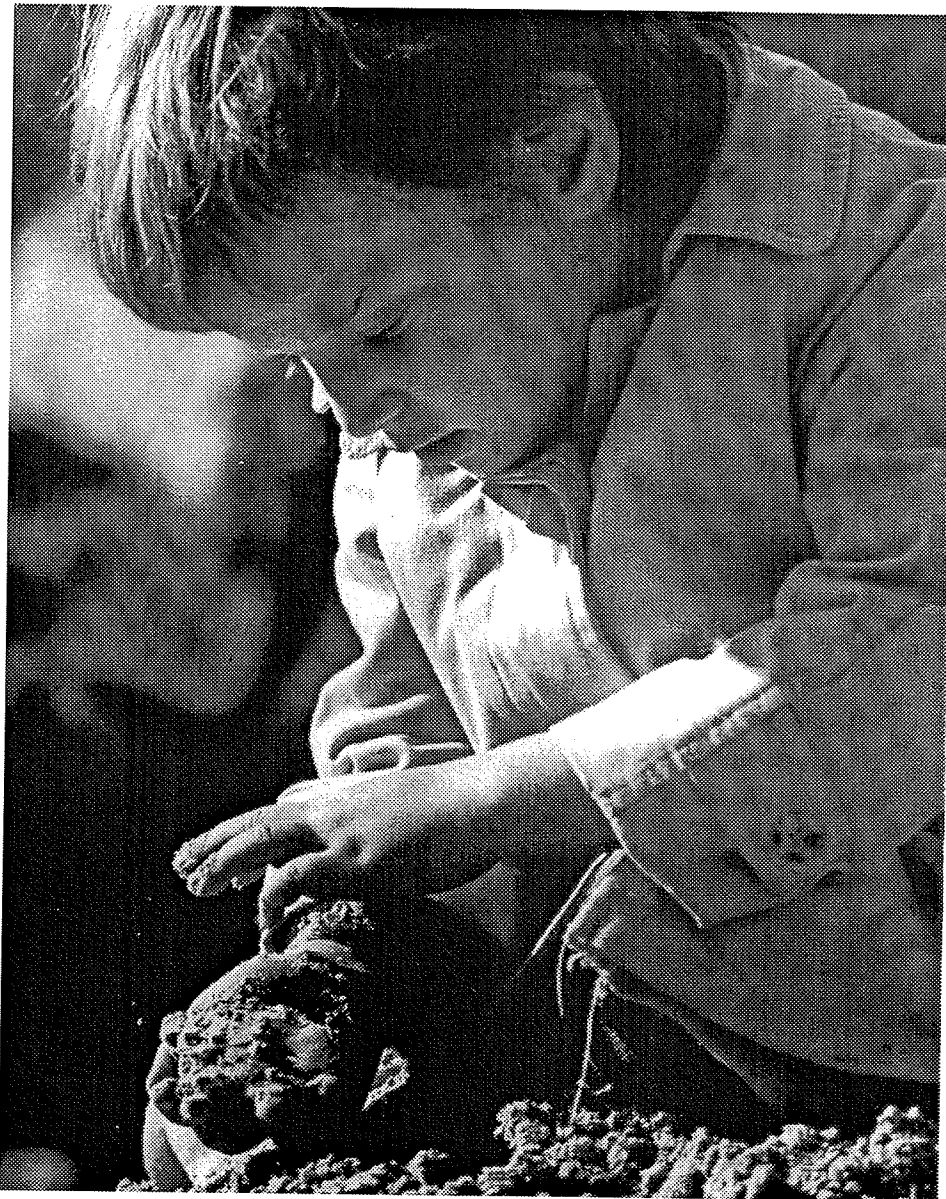


FIGURE 2: The Preoperational child - curious about the environment.  
(Source: Lorie, p. 71)

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2 Berger, Kathleen S. The Developing Person Through the Life Span, 2nd Edition. New York: Worth Publishers, 1988, p 177.

These are typically active children, alert keen observers, with vivid imaginations who learn best by doing. They are often difficult to reach because of a limited ability to absorb formal instruction, and a short attention span. Vocabulary and word comprehension is limited which requires keeping material simple. They are just beginning to learn what goes on around them and may have mistaken concepts, which they test in many ways. Dramatic play and talk are ways of testing what they have seen and heard; their method of seeking out ways to clarify these concepts.

The Pre-operational age group often demonstrates a strong affiliation to the natural environment. Their curiosity makes them open for discovery and their lack of fear often provides for a very uncluttered objective view of the world.

#### *Characteristics of the Concrete Operational Child*

Also referred to as school age, this stage covers ages eight to twelve and is considered to have the greatest degree of mental and physical maturation. Growth is slower and the body shape begins to look like an adult. The children within this classification are becoming interested in games and rules and as a result begin to develop concepts and problem solving skills from these experiences. Though they are generally more mature mentally than physically, hands-on activity and experimentation is still more appropriate than fatiguing mechanical seat work.



FIGURE 3: The Concrete Operational Child - taking responsibility for the environment.  
(Source: Tilger, p. 129)

They are starting to understand and form opinions about the world around them. The child is often quite fearless, self-motivated and to a large degree self sufficient (in that they can accommodate their own needs). They are able to and generally prepared to take greater responsibility for the things they do.

Research suggests that, with respect to environmental education, this is an appropriate age range within which to strengthen the knowledge base that serves to rationalize or explain the subjective notions they hold about the environment. To paraphrase, they like or dislike something, but can not explain why. Children in this stage are at the age when they might feel a children's museum is beneath them. The challenge is to create a playful and intriguing setting that won't be construed as being for "babies". Providing a sense of adventure and degree of control over the happenings or outcome of the experience will often mitigate this feeling while at the same time help them feel that they can make a difference.

Environmental experiences help children recognize relationships between concrete things and ordered events, and provide relevance to concepts. Children need concrete experiences in a variety of environments to encourage discovery, experimentation, and exploration through which they can generate concepts about their world.

### **Individual Appropriateness and Learning Styles**

There are many factors affecting the way a child develops: individual genetic inheritance; early relationships with family members; the amount, variety and quality of exposure to materials and ideas; and limits imposed on development, such as illness or economic situations. As a result, developmental stages can only be applied very generally as a basis for making programmatic and design decisions.

Learning style theories provide a basis for addressing the different ways that children take in and process information. Rooted in the discipline of cognitive psychology, learning style theories describe the characteristics of how a person prefers to learn. The basic assumption underlying most learning style research is that individuals have consistent preferences for an intellectual way of functioning across a great many different problem solving and decision making situations.

Following are three distinct types of personalities which exist, along with a brief description of their inherent styles of learning:

1. kinesthetic (the active learner - individuals who have to touch and move objects),
2. visual (the observer and passive participants - learns by watching others)
3. sensory (the intuitive learner - relies on more than just touch, tending to be emotive and relying on perception)

These descriptions illustrate that there is no single perfect method of presenting information which will ensure comprehension by all. The importance of striving for variety in the types and intensity of encounters, so as to cater to the widest possible audience, is immediately evident.

## **Moral Development**

Moral development is very much a part of personal development, it is part of becoming a fully functioning individual. As well, it is fundamental to establishing environmental concern. As such, moral or ethical development should be positively influenced.

Developing morality or values is not just a matter of telling what is right, it must be supported by knowledge, strategies and technique. Damon proves that morality exists naturally in children, and therefore suggests that it is a mistake to make morality a set of external standards foisted *on children by adults*.<sup>3</sup> Children have different moral issues we fail to recognize, and what is more confusing is that their moral judgment and behavior changes with age.

Kohlberg suggests that morality develops in a hierarchical, sequential nature; these too are loosely related to age (Seifert, 1983). He has identified six stages.

### Stages of Moral Beliefs According to Kohlberg

Stage 1: Punishment/obedience	Defined by externally imposed rules and rewards and which avoids punishment.
Stage 2: Market exchange	Whatever is agreeable to the individual and those to or from whom one may give or receive favors; no long term loyalty.
Stage 3: Peer opinion	Whatever brings approval from friends as a group.
Stage 4: Law and order	Whatever conforms to existing laws, customs, or authorities.
Stage 5: Social contract	Whatever conforms to procedures for settling disagreements in society; the outcome is not necessarily good or bad in itself.
Stage 6: Universal principles	Whatever is consistent with personally held, abstract moral principles.

Children may be aided in their moral development in one of two ways; by posing ethical dilemmas and then discussing solutions at one stage higher than their existing stage of

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<sup>3</sup> Damon, William. The Moral Child; Nurturing Children's Natural Moral Growth. New York: The Free Press, A Division of MacMillan, Inc., 1988, p.2.

ethical thinking; or by using a values clarification process which is described in the next section.

#### *Values Clarification Process:*

According to Damon, values clarification begins by assuming that a value is a process rather than an object or idea, with several elements identified in the process of valuing.

- |          |   |
|----------|---|
| Choosing | 1. freely   |
|          | 2. from alternatives  |
|          | 3. after thoughtful consideration of the consequences of each alternative |
| Prizing  | 4. cherishing, being happy with the choice                                |
|          | 5. willing to affirm the choice publicly                                  |
| Acting   | 6. doing something with the choice  |
|          | 7. repeatedly, in some pattern of life                                    |

The process of identifying values involves undertaking activities that are guided by questions designed to encourage open-ended replies. These ultimately are intended to encourage individuals to elaborate on their values and reach their own conclusions. Problem solving is considered an important aspect of values clarification.

#### *Indicators Of Values*

Damon contends that the process of identifying values can never be done with complete certainty, but that several behaviors tend to indicate their presence:

1. Expression of goal or purpose: what an individual wants to accomplish over the short and medium term.
2. Aspirations: an individual's longer term goals; "in one's wildest dreams".
3. Attitudes: what an individual is for and against.
4. Interests: what an individual likes to spend time doing.
5. Feelings: what an individual likes and dislikes.
6. Beliefs and convictions: what an individual considers right and wrong.
7. Activities: how an individual spends time.
8. Worries, problems, obstacles: what concerns or hassles an individual.

The goal of this approach is to help individuals to utilize the process of valuing in their own lives and to apply these value processes to already formed beliefs and behavior patterns and to those still emerging. An environmental education program should include experiences and processes that encourage moral development and help shape a fully functioning individual.

## Childhood and Learning

In childhood, learning is an indivisible aspect of development since every encounter is generally a new experience. A child is born into a world containing himself, knowing only that which he can see or experience. Over time, experiences and environments encountered by the child are slowly added to his world. Actions and reactions are absorbed through a process of trial and error resulting in the continual growth and change in the child's perception of himself and the world around him. This is learning.

Learning is best described as a journey, not a destination. The journey is not limited to one institution or environment but is "guided by the decisions made on what we value and the places supported to perpetuate what we value."<sup>4</sup> And although it is a complex process, children do not need to be forced to learn; they are motivated by their own desire to make sense of their world.

The child engages in two worlds, that which can be measured and calibrated and that which can be felt with heart and imagination (Bredekamp, 1978). Being sensory beings, children acquire knowledge about the physical and social world in which they live through playful interaction with objects and people. Therefore every opportunity should be given them to actively participate in their environment through concrete, play oriented approach: to touch rather than just look. By encouraging them to enjoy new experiences, new discoveries and new insights, and to be curious, skeptical, realistic, cooperative, tolerant of differences in others the end result is a more competent and self confident person.

### Play and Exploration: The Work of Children

The importance of play in development and learning must not be underestimated. Learning is a by-product of play and is, as such, considered inseparable from it. Adults tend to devalue play as frivolous, and unproductive; considering it merely for its amusement value; an opportunity to vent energy. Rarely is it associated with the concept of learning. In actuality it is a vital and critical part of a child's development, being linked with creativity, problem solving, language learning and the development of social roles. There are many theories of play and its significance in human development. Taken individually, no single theory adequately explains the rich diversity and benefits of play or even accounts for the constructive and imaginative play that exists. Children's concepts and language gradually develop to enable them to understand more abstract or symbolic information. Even reading and writing are governed by playful experiences, in that the abilities are learned by handling objects and talking about them.

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4 Ambach, Gordon M. "Museums as Places of Learning." Museum News, December 1986, p.41.

The essential qualities of play that differentiate it from work or leisure are that it is: pleasurable, has no extrinsic goals, is spontaneous and voluntary and it involves active engagement by the participant.

To illustrate the complexity of play as a basis for development and learning, it is often broken down into categories. It is important to note that the divisions are not clean and separate, as most activities combine elements.<sup>5</sup>

*Creative play:*

Creative play uses the imagination and limited muscular ability (fine motor skills). Through the creative process the child has the opportunity to find out about textures, weights, colours and balance; all the basic qualities that will affect them through life.

*Imaginative or Fantasy play:*

This is similar to creative play except that there is usually no tangible product. An object or utensil can be the catalyst for a whole series of situations and escapades. Dressing up, playing house and role playing are all examples. Through this form of play children try out different roles and reactions to varied situations and people.

*Active or Adventure play:*

Beneficial for adaptive development, children gain mentally and physically by reaching new heights by testing and extending their abilities. Active developmental play helps the child master his or her own body and exercise intelligence. This would include: manipulative toys, dramatic play or equipment props, problem solving with other children and adults.

*Destructive play*

This play can be interpreted as the beginning of the creative process, rather than the destruction of an object. In this mode objects are reduced to their basic components to help children understand what they are and how they work or how they might be salvaged.

*Social play*

There are a variety of ways in which children play in relation to others.

- a) Solitary play: This play is entirely within the mind of the person and may include the use of an object or utensil. It is helpful in the development of emotional independence and self-understanding.
- b) Parallel play: This type of play involves children playing beside each other, but not with each other. Through parallel play, the child is exposed to the way in which other children play and may be motivated to try new things. If children

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<sup>5</sup> The following descriptions were compiled from many sources.

nearby are playing with similar materials, there is an opportunity to compare one's own skills and methods and to try new ways.

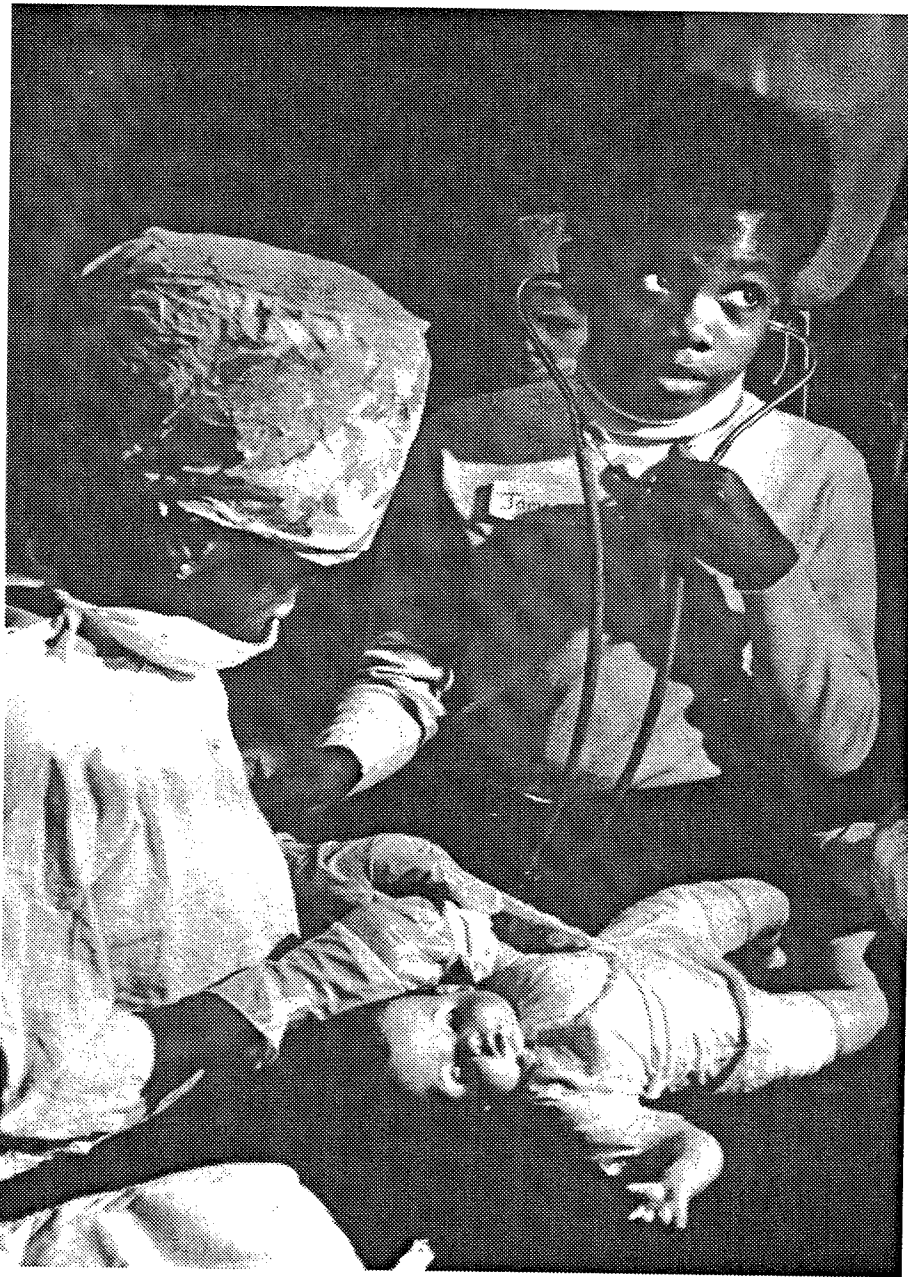


FIGURE 4: Role Playing/Fantasy Play.

(Source: Garvey, p. 78)

- c) Competitive play: A child plays with one or more children with the intent to demonstrate greater ability or superiority over his or her playmate(s). Often in a game situation this competition creates opportunities to develop improved skills and abilities, such as endurance, and in the process gain an understanding of ones strengths and weaknesses. Competitive play provides



an opportunity to learn the skills that accompany winning and losing. When applied to a group situation, aspects of cooperative play and peer pressure emerge as each group tries to coordinate efforts to achieve results.

- d) Cooperative play: Play between children with an intent to reach a mutual, personal goal. A common feature is sharing of resources. The value of the particular activity is an opportunity to develop skills of negotiation, compromise and conflict settlement. When applied to a group situation, the child learns to recognize the importance of everyone's contribution. This is a prelude to group decision making and problem solving dynamics, as well as the development of leadership and human relationship skills.

Competence is derived from two sources: during conscious striving to acquire new skills and knowledge, and naturally through performance and practice in play. Play is an important activity to developing competence, as it accomplishes six developmental functions:

1. Adaptive - biological adjustment/develop strength, stamina, speed
2. Expressive - emotional (tension, inquisitiveness, fury, hate)
3. Explorative - means through which to allow natural curiosity to govern action
4. Productive - how to make things and how to alter them
5. Communicative - behavior in relation to others (cooperation, acceptance of rules, empathy)
6. Cooperative - measure strength, to win and lose (Manning, 1990).

### **Lifelong Learning**

"Young children quickly develop concepts about how the world operates, many graduate holding the same views they had in kindergarten."<sup>6</sup> Therefore it is important that their natural curiosity and intrigue about the world be fostered, enriched and refined over the years.

Education is an artificial arrangement designed to promote a special kind of learning. "But education is no more the whole of learning than youth the whole of life. Learning is an attribute of total human condition which endures through life"<sup>7</sup> It begins with attitudes and habits that are shaped early in life and set the pattern and desire for the future.

The child's earliest experiences have a profound and lasting effect on later interests and achievements. The potential for starting children on a course of lifelong learning depends

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6 Suzuki, David. Inventing the Future, Reflection on Science, Technology and Nature. Toronto: Stoddart Publishing Co. Limited, 1989, p.207.

7 Oliver, Hugh. Sharing the World: A Prospect for Global Learning. Toronto: The Ontario Institute for Studies in Education, 1987, p. 19

on the degree to which principles of developmentally appropriate practices are performed (Bredekamp, 1987). Instead of viewing children as passive recipients of predetermined packages of knowledge, children should be viewed as active learners with unique and individual needs and abilities, who learn because they need and want to know and understand. By contrast to the traditional model used in schools, the goal of any educational environment should be to instill in children the desire and capacity to continue to learn throughout life rather than to produce completely "educated" people. Childhood, including the time spent in school, is considered an important stage in life not just a period of preparation for life (Coates, 1974).

Since the ways that children learn are likely to become lifetime habits and patterns of learning, it is important that children gain the skills needed to acquire knowledge. If children learn to think of themselves as inquirers, this concept is likely to remain with them. Young children can develop problem-solving skills at an early age if they are in settings where exploration and discovery are encouraged. Problem solving skills give children freedom to do their own learning. The feeling of competence that follows successful explorations and discoveries builds confidence, leading children to further probing. Children can gain independence as they become aware of the problems around them or they can become dependent, fearing to face problems and looking to adults to tell them what to do. As children solve problems they are developing the ability to cope with their world.

Challenge helps children develop a good "self concept", and establish good relationships with others. This is particularly relevant when addressing environmental concerns:

Make your pupil attentive to the natural phenomena and you will soon make him curious: but in order to nourish his curiosity never be in haste to satisfy it. Ask questions that are within his comprehension, and leave him to resolve them. Let him know nothing because you have told it to him, but because he has comprehended it himself; he is not to learn science, but to discover it. If you ever substitute in his mind authority for reason, he will no longer reason.<sup>8</sup>

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8 Source Unknown

## 2.2 EDUCATION AND THE ENVIRONMENT

The relationship between children and nature today is a complex one; on the one hand childrens' sophistication about the global environmental issues is very high and intensely felt. On the other hand, nature has become something to wear, watch and consume. The advent of television has served to bring worldwide marvels right into our living rooms, yet today's youth are largely ignorant of the mysteries of the earth. For the majority of society, the respect and reverence for the natural environment has changed from our ancestors. Many lack the intuitive understanding and compassion that comes with spending time among leaves, trees, soil, mosses, worms and puddles. At an early age, awe can be displaced by unconscious indifference as a result of being alienated from the natural environment. Our estrangement from the land "is so great that we have no sense that it [the natural environment] is sacred or that our ability to [use and] exploit it is a great privilege accompanied by responsibility."<sup>9</sup>

The cumulative affects of societies' attitudes and actions are beginning to threaten the earth's resources, and subsequently the quality of the planet for future generations. "We have become so puffed up with pride in our technological prowess, our computer-amplified intelligence, and the transcendent importance of economics that we have reduced the underpinnings of life itself - air, water, soil, other life-forms - to the status of mere commodities for our species' use"<sup>10</sup>. All living things on this planet depend on the energy of the sun, on water, and on minerals and nutrients of the earth.

Peoples misunderstanding and lost perspective of their place in the environment implies a need for education. Any attempt to protect the natural environment is dependent upon every person realizing that they are key contributors to the environmental problems and deciding to adjust their lifestyles and encouraging others to do the same. This type of environmental advocacy is best achieved through direct contact and experiential discovery, over instruction. In this way the environment is considered not just as a subject, but a setting and an objective as well.

### Responding to a Need - Focusing on Systems & Cycles

One of the most difficult things to convey about the environment is the notion of interconnected cycles and systems. But it is also one of the most important considerations for understanding the intricacies of the natural environment. Many of the environmental education centers have dealt with systems from a habitat or community level but to date no examples illustrate *man's* place in the complex interplay of natural and man-made systems. (See Appendix B - Local Environmental Education Programs.)

<sup>9</sup> Suzuki, David. A Time to Change. Toronto: Stoddart Publishing Co. Ltd., 1994. p. 158.

<sup>10</sup> Suzuki, David. 1989, p. 183.

A local school administrator stated that the one thing that would be beneficial to the environmental education program is a way of giving children a hands on, realistic portrayal of a complete cycle. Children see the food on the table and the water in the tap, but they have no real concept of where either have come from or where they end up, besides going 'away'. Children (and some adults) need to see and realize that nothing ever goes away completely. Hopefully with that understanding they will be more conscious of what they add to the systems and leave behind as a legacy to generations to come.

## **What is Environmental Education**

"The environment "as a concept extends beyond "ecology" or "natural history" or "surroundings" to involve the total interactions of living things, physical systems and the institutions of society."<sup>11</sup>

Therefore, environmental education is more than a topic; it is a focus and a specific process which facilitates an increased understanding about the complex interactions between man and natural systems and an understanding about their place (impact) on those systems. It "seeks to develop a population that is aware of and interested in the environment and its associated issues and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively toward solutions of current problems and prevention of new ones."<sup>12</sup> It is also about learning and practicing the conservation ethic needed to ensure that nature as we know it, survives. Most importantly, it is learning about ourselves, about how we live and what we value; meaning that the process of recognizing values and clarifying concepts is a necessary step in the development of an understanding and appreciation of the inter-relatedness among man, his culture and his bio-physical surrounding.

Environmental concerns have been a focus of the education system in one form or another for many years. Schools have been a powerful and important proponent of environmental issues. Unfortunately programs are often limited by the structure of the curriculum, or have been dependent on interested individuals and have therefore often lacked consistency and continuity. Recently governments from around the world have taken a firm stance on the need for public education. "Our Common Future", the 1987 report of the Brundtland Commission, gave political credibility to a concept that had been developing for years (Roseland, 1992).

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11 Schoenfeld, Clay, "The Environmental Communications Ecosystem: An overview of the Field" in (Ed). Interpreting Environmental Issues: Research and Development in Conservation Communications. Madison WI: Dembar Educational Research Services, 1972, p. 14.

12 EE2000: Environmental Education for a Sustainable Future. Environmental Education Advisory Committee to the Environment Council of Alberta. Alberta: Environment Council of Alberta, 1989, p. 3.

Today the term 'environmental education' defines a methodology for more efficient learning and recognizes that outdoor experiences enhance understanding. It is not simply a topic to be taught but a value system that governs our lives. It is a philosophy for how you choose to live your life on this land and the efforts you make to ensure a healthy planet.

### Educational Goal - A Proactive Population

A major function of environmental education is to change attitudes and subsequently behavior toward the environment. The goal therefore is to appeal to peoples' intelligence and sensitivity in hopes of inspiring more effective ways to live in harmony with the natural environment. Humans must acquire the care and knowledge necessary for making informed environmental decisions. The ability to understand how man-made systems impact natural processes requires that one must first understand the basics of the natural processes. Opportunities and experiences need to be provided for successful achievements and environmental understanding. This will build confidence and instill a sense of "I can make a difference". How do we facilitate or inspire this attitude or belief?

It is important to focus on the children in the early years, when lifelong learning attitudes are set, for two reasons. Firstly, no group has more at stake in the resolution of the environment crisis than the youth of today. But more importantly, young people are more receptive to new ideas, not having yet invested heavily in the status quo. They see with embarrassing clarity, not blinded by fear, vested interests in a career, or the lure of consumerism. (Suzuki, 1994). This is why youth are often the best ecological activists.



FIGURE 5: Itsy-Bitsy Spider Comic  
(Source: "Baby Blues", Winnipeg Free Press, Date Unknown)

Children have a natural curiosity which is often snuffed at an early age. "Children learn attitudes and values quickly by watching others, and the lesson in cities is very clear : Nature is an enemy; it's dirty dangerous and disgusting. The message urban kids get runs completely counter to what they are born with, a natural interest in other life forms. . . Society conditions them out of it." <sup>13</sup> Children should be encouraged to develop a curiosity of the world; to look at it with open mind and make sound decisions based on the best evidence possible. Since enthusiastic, interested children are a snap to teach at any level, an emphasis should be placed on finding ways to instill excitement and interest in the world around.

As direct dependence on adults fades, children desire a stronger connection in the environment. This desire to investigate, explore and try, peaks between the ages of 8-12. During this time the child develops a deep and romantic connection with the environment, particularly with areas such as empty wood lots which are not normally designated as a child's domain (Manning 1990). It "is a crucial age for much more important matters than reading. It is the age for finishing the development of the important bonding with the earth and for development of primary process thinking."<sup>14</sup>

### **Developing an Environmental Consciousness**

Before we can expect lifestyles to emerge in which people actively pursue environmental well-being in a decisive way, we have to have a society that acts out of respect for the natural environment. This respect can only develop as an evolving level of consciousness. This gradual refinement of a frame of mind is as much governed by intellectual thought as it is of affective considerations. True appreciation is derived from the combined effects of thought, touch, hearing, smell, sight, sound. Only out of the many concrete experiences and opportunities can an understanding of inter-relatedness be comprehended.

The arguments for a rich experiential basis for learning are already proven. Environmental learning is an experience-oriented, investigative, problem-solving concept that seeks and nurtures diversity in learners. It deals with development of sensory perception, with problem identification, with attitudes and feelings as commitments, with self-awareness and growth toward self-potential. It fosters joy and involvement in learning. It seeks to develop individuals with the self-confidence to identify and solve problems on their own and the larger societal environment through an open-ended, multi-disciplinary, concept-based orientation. It seeks a lifelong learner who can process, not parrot information and use this to improve the quality of life.

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<sup>13</sup> Suzuki, 1989, p. 185.

<sup>14</sup> Devall, William. "A Sense of Earth Wisdom." *Journal of Environmental Education*, Vol. 16, No. 2, Winter 1984-85, pp 1-3.

The following list illustrates the stages involved in the development of environmental consciousness.

Cognitive & Resulting Affective Human Qualities  
Characterized by Increasing Environmental Consciousness

ENVIRONMENTAL LITERACY

*Awareness* ..... expressed as ..... *Interest*  
*Sensitivity* ..... *Appreciation*  
*Knowledge* ..... *Understanding*

ENVIRONMENTAL ETHIC

*Concern* ..... *Respect*  
*Skills* ..... *Responsibility in decision-making*  
*Commitment* ..... *Action*

ENVIRONMENTAL ADVOCACY

a) *Environmental Literacy*

This refers to an acquired understanding of natural systems and a sense of how human systems relate to them. It begins with simple interaction and observation of natural phenomena and expands to a increased interest and appreciation of processes and relationships. Some of the indicators of this stage are:

*Awareness* - as it relates to perceptions: opening ones eyes to look and to see, and to absorb. Once a person starts to recognize new things, they become increasingly interested in the other intricacies.

*Sensitivity* - relates to the emotional attachment one develops - an instinctive, heightened awareness, and an empathetic perspective which is demonstrated through expressions of appreciation and awe.

*Knowledge*: - the intellectual justification for how the environment functions, based on an acquaintance with facts, truths and principles that serves to rationalize intuitive premises. People need to possess a knowledge of ecology, how people interact with the environment and how issues and problems dealing with the environment arise and can be resolved or why things are important.

b) *Environmental Ethic*

Represents a state at which an individual makes environmental issues very personal; having prescribed a degree of ownership, such that they are motivated by intrinsic not extrinsic rewards. It is the result of an evolved level of conscience and commitment that comes from applied knowledge and sensitivity; a value that understands and promotes survival of the ecosystem. It implies the ability to sense and describe the role of any activity in shaping the environment and using the acquired knowledge and skills to take thoughtful, positive action toward the resolution of environmental problems and issues. Attitudes and values are as important in solving environmental problems as is knowledge.

*Concerns* - the emotion that is the basis of positive values for the environment and motivation to participate in environmental stewardship. The awareness of how and why a resource should be used and protected leads to a sense of responsibility and a desire to become involved. Concern for an impending problem is the synthesis of all the conditions of environmental literacy.

*Skills* - predominantly decision making and problem solving techniques, which emphasize identification, investigation and contribution to the resolution of environmental problems or issues. It is the ability to perceive and discriminate among stimuli, and to process, refine and extend those perceptions into personal solutions to environmental problems.

*Commitment* - Personal investment evidenced when lifestyles and decision making are governed by concern and determination for environmental preservation, conservation and stewardship. For some, this translates into public participation programs, seeking out opportunities to be actively involved at all levels of problem resolution and prevention. Actions range from changing seemingly insignificant habits to becoming active in organizations.

c) *Environmental Advocacy*

Beyond personal choices, trying to make a difference outside of one's personal circles. Defines a feeling of empowerment, variables that give people a sense that they can make changes. Environmental advocacy must be premised on both literacy and ethic, otherwise it lacks the informed intuitive commitment that perpetuates motivation.

Environmental literacy is an important foundation of motivation and action. One cannot establish a valid or convincing ethic if the literacy does not accompany it. Without the knowledge and sensitivity, any value is merely a reiteration of someone else's belief, or is purely intuitive in which case, while it may be perceptive, lacks conviction and substance. It is only once a personal value is placed on the environment that change will result. This means that the population needs to attain a level of environmental literacy and hopefully a value system will evolve.

### **Characteristics of an Effective Environmental Education Program**

Aside from specific environmental messages, a number of basic, but key concepts and abilities are recognized as important to the development of an effective and comprehensive education program. They include:

- Systems thinking
- Making and evaluating decisions
- Understanding and clarifying their personal values
- Cooperative learning
- Experiential learning



#### *a) Systems Thinking*

Systems thinking as applied to the environment is the ability to perceive and understand the complex cycles that moderate the natural environment and the natural cause and effect which keeps the system in balance. It builds on the idea of interrelationships; the connection between the individual and the environment; between cause and effect; between changes and consequences and of compromise. It calls for a more holistic view and approach to assessing and dealing with problems.

#### *b) Learning to Make & Evaluate Decisions*

In a learning environment where the emphasis is placed on decision making, a greater emphasis also gets placed on process and the acquisition of skills for preventing and solving problems. Rather than dwelling on the actual solution, the steps to addressing and solving problems becomes the focus. This requires opportunities to test and evaluation choices, and weigh alternative solutions.

#### *c) Understanding and Clarifying Personal Values*

Our values and attitudes are the underlying basis of who and what we are, and form the basis for the choices we make. Some values tend to be prevalent in society such as our insensitivity and indifference to the natural environment. Values clarification is of paramount importance in making rational environmental decisions every day of a person's life and must be a basic part of every environmental education program. "Know how' is not enough, we must have a clear system of values to guide it's use" <sup>15</sup>. Closely tied to values are our perceptions. Our beliefs shape the very way we perceive the world and what we accept as credible or dismiss as unreliable. " . . . once you understand the interconnectedness of air, water, soil, and biodiversity, you can never again look at environmental problems and phenomena in isolation from their local and global surroundings." <sup>16</sup>

For lifestyle change to be possible, we have to learn to think about issues of quality, using senses and feelings and intuition as well as the intellect. This includes the ability to separate numeric, quantitative assessments from what is moral or qualitative. It is worthwhile to stimulate an individual to examine his behavior by clarifying for himself his purpose, beliefs, attitudes and other value indicators. It helps to remove inconsistencies in an individual's life and encourages the development of self-concept." <sup>17</sup>

#### *d) Learning to Cooperate*

Global competition has lead to heightened awareness of the interdependence of people and nations, compelling society to seek new forms of collaboration (Manitoba Ed., 1990).

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<sup>15</sup> Schumacher , 72 from Manning , 1990, p.42.

<sup>16</sup> Suzuki, 1994, p. 161.

<sup>17</sup> Swan, James. A. & William B. Stapp. Environmental Education: Strategies Toward a More Livable Future. Beverley Hills: Sage Publications, 174.

Environmental issues are particularly complex, requiring cooperation at all levels. Skills in group processes and communication become very important in today's problem solving i.e.: community involvement projects, parent/child negotiations or team approaches, in political and social levels; global, national, regional, as well as local.

*e) Experiential Learning*

This recognizes the importance of first-hand experience. It is based on the belief that values are best accepted and adopted by involvement and participation in the real world, instead of hypothetical scenarios. In the case of teaching values an emphasis on direct contact with the natural environment as a stimulator, and encouragement of creative inquiry, cooperation and positive interaction, rather than abstraction (removal/separation) as a basis for learning, awareness and concern.

For environmental learning, outdoor experience is vitally important, particularly for children of the industrialized and urbanized societies. The urbanized child lacks contact with the physical world that supports them, so removed that they grow up expressing little knowledge, concern or appreciation for the natural environment. It is important that they understand and experience natural cycles, changing seasons and the beauty and mystery of nature.

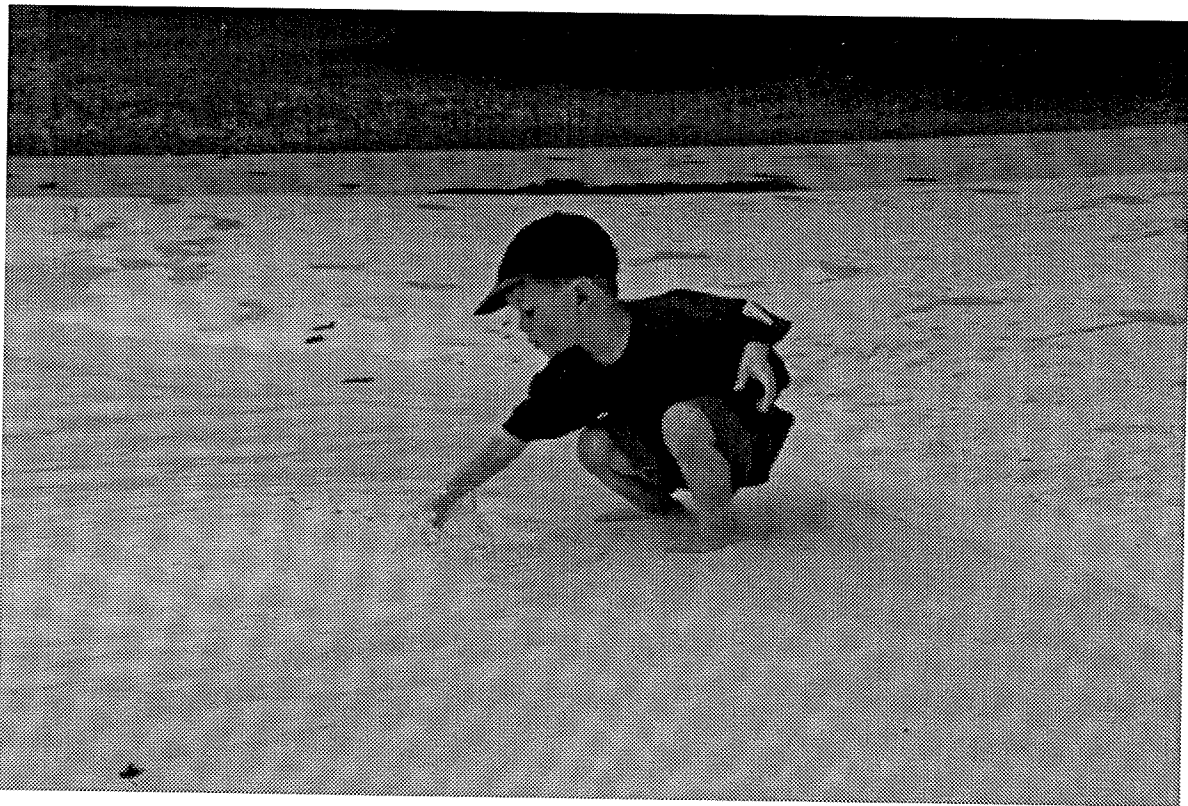


FIGURE 6: Experiencing Water

"For the education planner, the challenge is an awesome one - how to create significant experience for the child from which it is possible to develop capacities for thought, understanding and action; how to create experience in a proper context for potential learning; how to exploit this experience as opportunity for learning, how to facilitate the capacity to learn and how to come to grips with new experience, unfamiliar ideas, and new understandings, i.e.. how to make sense of them and derive meaning from them." <sup>18</sup>

### Approaches to Teaching Environmental Education

In environmental education there are three distinct strategies to evoking interest and concern, and governing the educational style and teaching

1. Shock value - look at the devastating predicament we're in (guilt/fear)
2. Sense of Wonder - reinforcing natural curiosity and fascination - (sensitivity)
3. The facts - providing comprehensive information in an effort to appeal to the intellect

All three methods are effective. However it is highly preferable to appeal to the more positive approaches. Many believe that experiences should be designed to stimulate in children deep, realistic, yet hopeful feelings for the earth, to offset and mediate later messages that might lead them to become discouraged or cynical about their effect on our complex and unfathomable world.

Deborah Simmons <sup>19</sup> states that a study conducted of children's perceptions of a variety of environments clearly detected that despite urban children's fascination with natural environments, they harbor some deep seated fears associated with them. The aim therefore should be to increase their sense of comfort, by focusing on the creation of positive experiences.

A positive learning environment is one that encourages people to experience new things in their surroundings and delight in their discoveries; to wonder about something they find and try to seek answers to questions or when they become concerned enough to do something to improve their surrounding. "When people see issues as very grim, urgent, and overwhelmingly huge and complex, it is not surprising that their perceptions will verge on futility and hopelessness. On the other hand, coming to an understanding of an issue within the context of what to do and where to start may prove more empowering."<sup>20</sup>

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<sup>18</sup> Adams, Eileen. "Learning to See." Children's Environments Quarterly, Vol. 6, No. 2/3, (Fall) 1989, p.44.

<sup>19</sup> Simmons, Deborah. "Urban Children's Preferences for Nature: Lessons for Environmental Education". Children's Environments. Vol. 11, No. 2, 1994, p. 201.

<sup>20</sup> Bardwell, Lisa. "Success Stories, Imagery by Example." Journal of Environmental Education, Vol.23, No. 1, Fall 1991 p. 8.

Bardwell demonstrates that a personal outlook can determine the difference between peoples active participation and helplessness. A large part of this outlook is dependent on self competence. Competence relates to an individuals sense of empowerment and implies a confidence in personal abilities and in the effectiveness of ones efforts, in other words. whether one feels capable of addressing the issue. This means matching what one can do with what must be done. The opposite - helplessness, can lead to people giving up or conceding. " . . . when people see issues as very grim, urgent, and overwhelmingly huge and complex, it is not surprising that their perceptions will verge on futility and hopelessness. On the other hand, coming to an understanding of an issue within the context of what to do and where to start may prove more empowering."<sup>21</sup> An example of positive based learning is an issue-based focus instead of a problem-based focus. Issues are immediately more positive in that they represent a balanced, comprehensive perspective and therefor command a proactive, forward-thinking from of resolution; solve it before it happens. However, problems put people on the defensive and offensive, such that rather than being inspiring they can become paralyzing.

In cognitive terms competence usually means that an individual who is a good problem solver,:

- 1) knows what to think - has a mastery of the information and is able to break it down to fit different contexts and identify different approaches
- 2) knows what to do - through logic and common sense develops sound solutions to problems that arise
- 3) knows what to expect - having considered all the angles, generally possesses forethought
- 4) does not feel the fool to try - is not self conscious

Part and parcel of developing competence in youth is that each feels comfortable and confident in choices and decisions to be made. The first lesson for harmonious living is self knowledge. It is not difficult to realize that before people can expect to live in harmony they must be in harmony with themselves; one who does not like and understand himself, or is preoccupied with insecurities, will have a hard time understanding others and grow towards global awareness.

Learning about environmental issues, their complexity, urgency and importance can be overwhelming. Typical responses offer limited effective solutions. There may be denial that the problems are real and pressing, or an individual can be overcome by a feeling of fatalism - that nothing can be done. It confirms that just providing the 'right' information does not mean people will respond appropriately or at all. Quite often being told what to do only causes the opposite response.

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<sup>21</sup> Bardwell, p. 9.

There are programs that do not promote environmental "knowledge" in that they are "non prescriptive". They are designed to present a specific 'message' (to stop littering, to recycle, to save the salmon, save precious fuels etc.) These are admirable goals and are issues worth pursuing. However, individuals can be confused when faced with a myriad of conflicting messages. Furthermore, it reinforces a dependency on single sources of information which is in conflict with the environmental education goal of encouraging individuals to critically examine the issues and reach their own conclusions (Robinson, 1982).

With education systems across the country focusing more and more on the environment, the museum has a valuable support role to play. Exploration becomes limited in school systems by the necessity to fall within restrictive time tabling and conform to provincial standards. Besides that, education is among the most dormant of all institutions, protecting society's most stable values, so change is usually met with resistance. As a result, educators are often forced to compromise the intended 'radical' thrust by introducing ideas as 'topics' into existing curriculum, thereby reducing its impact.

The children's museum has the ability to pick up where the school system leaves off. However, difficulties related to presenting environmental issues are manifest. Their magnitude and complexity present a special problem and their interpretation through exhibits, especially the interactive kind favored by science centers, creates an exceptional challenge for designers (Cohen & McMurtry, 1985) .

### 2.3 CHILDREN'S MUSEUMS - Places of Discovery

Children's museums, science centers and discovery centers represent an emerging trend in museum type learning environments that aim to create more participatory learning opportunities. Where science centers are generally geared toward scientific phenomena, children's museums and discovery centers offer a broader scope, often relating to local or current issues.

*Tell me, and I will forget,  
Show me, and I will remember.  
Involve me, and I will understand.*<sup>22</sup>

This proverb encapsulates the philosophy of Children's museums and their commitment to learning. Children's museums understand the need for children to touch, manipulate, and experiment with their environment as a necessary part of learning. They also recognize that the physical environment affects the behavior and development of both children and adults. The quality of the physical space affects the level of involvement as well as the quality of interaction between parent and child.

Children's museums emerged at the start of the century, the first being established in Brooklyn, New York, in 1899. There are now over 200 children's museums and youth centers in the US, almost one in every major urban center. Over the last century the format and intent has evolved from the traditional collecting gallery to the more popular exploratory center.

They are a relatively new concept in Canada with only four in existence. Several are in the planning stages which could result in the doubling of museums in the next decade. The first to open was the London Regional Children's Museum in 1976, followed shortly thereafter by the Hamilton Museum (1978). In 1986 the Manitoba Children's Museum opened, and in 1989 a Children's Museum was opened as part of the Canadian Museum of Civilization, in Ottawa/Hull.

While each facility is different, they consistently incorporate the following mission:

- to allow children the opportunity for self-discovery, exploration and creativity.
- to empower children to respect and feel confident in themselves.
- to honor the natural state of curiosity within children
- to prepare children for entry into the 21st century by providing them with tools for change.

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<sup>22</sup> Ancient Chinese proverb quoted from Pitman-Gelles, Bonnie. Museums, Magic & Children: Youth Education in Museums. Washington, D.C.: The Association of Science-Technology Centers, 1981., p. 5.

## Characteristics of Children's Museums

Children's museums constitute an unique and rich educational experience as a result of their commitment and respect for the needs of their primary audience; children. And again, while accomplished in varied and intriguing ways, the mission is achieved by incorporating the following characteristics:

### "Client-Centered"

Children's museums are not museums *about* children but are specially designed and programmed facilities that recognize, respond to and focus on the needs, interests and abilities of children. The usual age range for the primary audience is two through twelve. Unlike the more familiar collection museums which focus on the subject matter, children's museums focus on the visitor. Grounded in theories in child development and educational psychology, exhibits and galleries cater to children's perceptions and abilities. Topics are selected, spaces are created, scale of items determined and ideas presented in a fashion that is specifically suited to the child learner/explorer. Based on the contention that people learn best through multisensory experiences, their unique and varied educational approaches appeals the needs of the broader audience.

This is one environment where children feel they have a degree of control or mastery. While parents and attending care givers are also accommodated in the spatial arrangements and encouraged to interact, it is not uncommon for a museum to incorporate a "just my size" space that is made for children.

Being confident and comfortable is critical to decision making. Because the physical environment is relatively simple, stable and available, while the social environment is overwhelmingly complex, ever shifting and controlled by parent injunctions, it is easier for a child to control their physical environment than social environment. This interactive arena promotes self confidence in the child (Manning, 1990).

### Active / Interactive Learning Process

#### *Active and Playful*

The basic premise behind a children's museum is that learning can and should be fun! They share a common spirit, character and goal in that they stimulate curiosity and motivate learning through delightful play and hands-on, interactive experience. (Cohen & McMurtry, 1985). Learning should not be a chore. Realizing this at an early age is the first step to developing habits of healthy lifelong learning.

Children's museums recognize the fact that learning for children is not a passive activity. They also respect children's level of development, their need for playful opportunities and sensory stimulation. Active learning environments reflect not only an educational philosophy but an indisputable fact that the primary museum users share an abundance of physical energy.



FIGURE 7: The Climbing Structure, Boston Children's Museum - Provides a variety of large and small spaces for climbing and hiding in an artistic and fun way.  
(Source: Hansen, p. 13)



### *"Please Touch" - Hands-on learning*

Unlike traditional museums, objects are not hidden behind display cases or hanging on the wall. Information and experience are not the same thing. "The communication inherent in the objects is more readily assimilated, and individually interpreted, than when it is abstracted and distilled through words by someone else."<sup>23</sup> Through looking, listening, touching, role-playing, and directed activity, exhibits and programs support a "hands-on, get involved" approach to learning rather than the traditional "look - see, don't touch".<sup>24</sup>

Hands-on experiences range from simply touching or handling objects to becoming totally immersed in the physical and emotional aspect of the subject matter. Touch is an important sense, it confirms mental images. Letting people touch objects is a way of breaking down barriers to communication and ultimately to knowledge. Children need the opportunity to fiddle with pieces of their world; physical things and mental things - observations, words, thoughts, ideas, gadgets, trinkets, books, pictures. A variety of opportunities can strike their curiosity or represent to them some unresolved mystery. Some people see a child's fiddling as trivial, something to ignore or to correct. However it is a natural behavior of human beings. Fiddling produces juxtapositions that can stimulate new insights when strange or unusual images and or ideas appear together.<sup>25</sup>

### *Interactive*

Children's museums frequently demonstrate the importance of providing more than just objects to be manipulated or acted upon; they also but opportunities to interact with. This can be as simple and enticing children to lift flaps for more information, or push buttons to activate a response and as complex as is required. The implication is that both feedback and opportunities to see varied results which are dependent on varied individual actions, provides a strong basis for learning.

### Multisensory

#### *Non-Verbal*

Museum learning is largely visual and tactile. The exploratory environments created in children's museums are most often created without the need for extraneous words or graphic depiction's or facilitator directed explanations. An advantage to this type of experiential learning is its nonverbal, universal way of communicating. It may be considered a barrier free approach to education and therefore valuable to people of all ages, since it allows one to choose what they want and provides the freedom to advance at their own speed without fear of failure.

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<sup>23</sup> Cohen, & McMurtry, 1985, p. 5.

<sup>24</sup> Quoted from Manitoba Children's Museum Literature

<sup>25</sup> Manning, 1990, p. 35.

The value of objects over writing and especially over words, are their multi-dimensional, multi-sensory attributes. "The communication inherent in the objects is thicker, often quicker, and individually interpreted, rather than abstracted and distilled through words by someone else."<sup>26</sup>

### *Sensory Enriched*

Activities stress stimulation of mental, physical and social development of children through mediums that establish conceptual frameworks for more traditional learning later. Exhibits appeal to a child's natural curiosity to explore by using intrigue and visual, tactile stimulation.

### Intergenerational

The attending adult's role in the discovery process is important. Adults are not only important guests of child visitors but active participants, facilitators and collaborators in the nurturing of life long curiosity, passion and caring. Active and mutual exploration of a child's world is the best contribution a parent can make to the child's future. (Bjorklid, 1982). Therefore, while children's museums are generally designed to appeal to children, the needs of the parent or adult whom the child has come with, must not be overlooked.

Most assume the intent is for children to learn from parents, however studies have shown that in most cases children do the initiating (Gallagher, 1987) while parents learn through observation and in trying to answer the questions that are posed. It is often said that the best way to learn is to try to teach someone else. The parent/care giver becomes an important partner to the learning process as teacher in the museum. Parents should have a central role in introducing children to museums as places of learning.

### *"Seeing The World Through A Child's Eyes"*

Pre-operational thinking lends the child's world it's magical quality. Children believe in elves and fairies, witches and spells, animals that talk and wear clothes. From an adult point of view, the earliest years are almost like a dream from which children awaken as the state of reason dawns at about age seven. But during these early years, children often surprise and delight us with their original ideas about how the world works. Seeing the world through children's eyes has the potential to renew interest, intrigue and curiosity in the adult. The absence of an interest in life trains people not to look, not to notice.. (Suzuki, 1989)

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26 Cohen & McMurtry, 1985, p. 5.

### *Children as Catalyst for Adult Learning*

"... even more than design for children, children's museums represent a 'design that stimulates the child in all of us'."<sup>27</sup> Children's museums support the role of the family members as children's first teachers. It strives to empower families to experience, explore and discover together, unrestricted by the more conservative didactic styles employed by traditional museums and schools.

Shared experiences with caring adults are essential in fostering a deep and lasting compassion for the earth and its creatures. "If children are to keep alive their inborn sense of wonder, they need the companionship of at least one adult who can share it, rediscovering with them the joy, excitement and mystery of the world in which we live."<sup>28</sup>

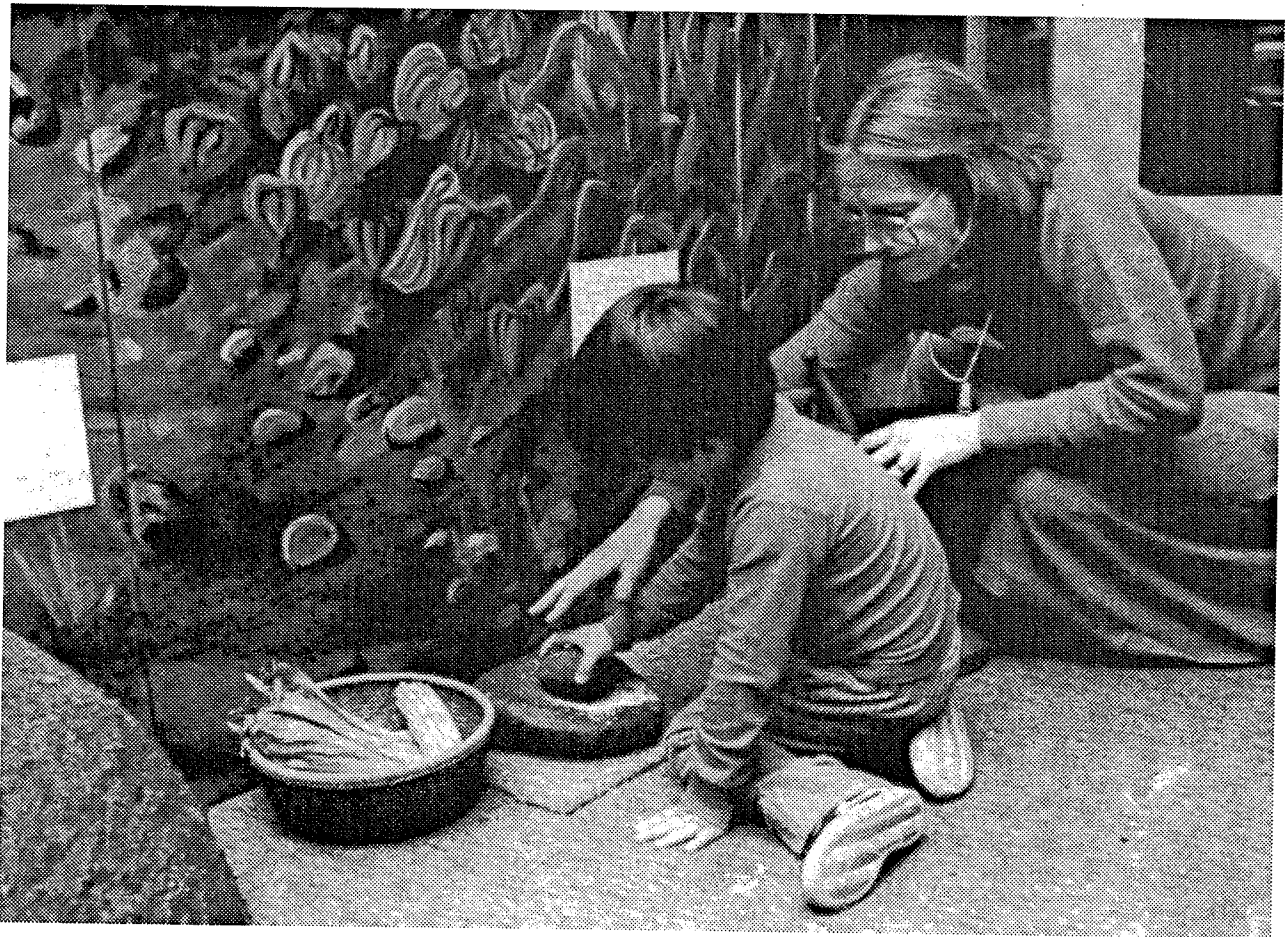


FIGURE 8: Intergenerational/Shared Learning

(Source: Gallagher, p. 42)

<sup>27</sup> Cohen & McMurtry, 1985, p. 2.

<sup>28</sup> Carson, Rachel. as quoted in Johns, F.A., Kurt Allen Liske & A. L. Evans. *Education Goes Out of Doors*. Don Mills, Ontario: Addison - Wesley Publications Company Inc. 1986., p. 1.

### *Promoter of Lifelong Learning*

Through their contextual galleries, participatory exhibits, interdisciplinary and multi-sensory programs, museums strive to create an environment which affirms the significance of lifelong learning.

While people are invariably positive about the Children's Museum experience and consider it a 'neat' place to explore, others would debate that learning takes place. Many adults' first impression is of anarchy and chaos, and many more treat the facility as a glorified daycare. There is a minimal amount of instruction going on (the things we tend to equate with learning) but that is what makes a children museum so special. It allows children to learn in the way that they do best, through self directed discovery.

### **Rich Combination of Varied Interpretive & Presentational Methods**

No two museums are alike. Some require interpreters, or docents, to act as facilitators, but more and more they are promoting self directed learning. In addition, a large part of the museum mandate includes educational and recreational programming, workshops and extension programs. They serve an important adjunct to formal education.

The terms *exhibit*, *programs* and *display* are used rather loosely when applied to a children's museum setting. Children's museums recognize that overly structured environments limits expressive freedom, so they offer an alternative to the often directive, interpreted and digested information that is processed through the more traditional sources - television, newspapers etc. (Cohen & McMurtry, 1985) Therefore experiences are provided in a variety of ways, but predominantly through interactive exhibits or displays.

### Exhibits and Displays As Mediums for Educating

Spatially an exhibit denotes a physical structure or space with a main purpose of presenting information or a special collection. Though the nature of the exhibit environment within a children's museum has witnessed a radical departure from the traditional displays or galleries, their overriding purpose or intent of exhibits remains the same. (Danilov, 1986) Among the prime goals of museum education is the stimulation of the visitor's imagination and development of sensory awareness. They strive to awaken visitor interest and curiosity and to encourage the development of ideas rather than an indoctrination of facts. In short the museums goals may be summarized by four points:

- *learn* basic principles
- *experience* relevance to every day life
- *develop* understanding
- *observe* capabilities

When applied to a children's learning environment, the real intent is to; encourage children to create relationships with events & objects; foster ability to invent problems and look for solutions; further creativity; encourage ability to think of different ways to do or use something; and provide a basis for later understanding of principles and relationships.

From a design perspective an exhibit represents the technique of rapid information transfer or instructional communication. Children's museum philosophy supports the belief that learning is not limited to the acquisition of information, but also involves the development of attitudes, skills and values. The interpretive creativity partnered with a commitment to encourage involvement is responsible for creating wonderfully stimulating experiences. The motivational mechanisms by which these types of opportunities might be facilitated are:

- pose a problem or situation: provide an opportunity to find or set up a problem and look for solutions or stimulate individuals to make predictions
- make the experience physically involving: entice involvement by producing interesting payoff or effect
- effect actions - witness the immediate and clear effect of one's action

### Presenting Subject Matter In Different Ways

Depending on the lesson or intended message, exhibits can simply provide information, or elaborate to express a point by demonstrating the impact on individuals personally. An effective exhibit helps people to recall knowledge, activate (trigger) response, and provide feedback through cues. The exhibit is a product of the subject matter and the method by which the designer chooses to interpret it:

- a) Aesthetic or entertaining - intent is for people to enjoy viewing the content and be entertained by it; the emphasis is on pleasing the view.
- b) Factual - intent is to convey information, which is hopefully useful or interesting to the visitor
- c) Conceptual - intent is to convey ideas or broad principles which the viewer will hopefully grasp, internalize (make part of his thinking) and thereafter act upon. This kind of exhibit does the most to change human behavior, which is the primary goal of education.



FIGURE 9: Treehouse, Philadelphia Zoo - An example of an aesthetic and conceptual exhibit for exploring and viewing the world through the head of a bee.  
(Source: Crosbie, p.59)

For each of these types any number of interpretive approaches may be used. Unearthing the different ways in which people learn about things with which they were previously unfamiliar can dictate the types of experiences designed:

1. definition
2. demonstration
3. interaction /participation (first hand, hands-on experience )
4. enactment (people best understand the things that they can do)
5. analogy (presenting familiar subject matter in unfamiliar ways or making sense of current events or problems by referring to similar type encountered previously: underpins all other methods)
6. animation/simulation (initiate a sense of adventure and discovery: achieved through manipulation of the visitors perspective of the exhibit and the physical space surrounding, for example, a larger than life scale or miniaturized to illustrate a particular point being made within the exhibit.

In Children's museums the three interpretive methods most commonly utilized are: interaction , demonstration and animation.

### *Communication Techniques*

Museum education differs from schooling in that attendance is not compulsory, leaving the visitor free to come and go at will, and to explore exhibits at one's own pace and according to personal interest. Because museum learning is voluntary, it must attract, stimulate and persuade the visitor to engage in exhibits and consider their implications.

The successful stimulation of ideas and opinions is dependent on a number of factors. The challenge in exhibit design is in finding an appropriate balance between making some intellectual demands and providing a degree of challenge, without overwhelming or causing the observer to feel inadequate.

Subject matter content and structure must be considered for suitability to determine what is teachable and what isn't. Establishing clarity of content and message ensures that the visitor is able to follow step by step or at least identify with the overall conceptual structure. One common pitfall is the tendency to explain the unfamiliar in terms of even less familiar. Continuity and coherence are important and prevent the visitor having to question why something is suddenly introduced.

A certain amount of intrigue and variety or novelty is required to attract individuals to the exhibit. But too much novelty can be boring and become a turn off. It is best to balance the amount of novelty with familiarity or, if possible, provide personal control over the degree of novelty. In the worst case too much novelty can sever a fine line

between the 'pure play' or 'conviviality' mode and stress. In pure play mode, problems, paradoxes and challenges are essentially non-threatening. The total absence of such things as worry, feelings of pressure and overload can have a positive influence on problem solving ability. Stress on the other hand can completely negate the experience.

Miles states that exhibits that inspire respect rather than merely comprehension will attract. Once enticed to get involved, there must be a worth while activity that makes a person's effort seem worth while and a holding power to keep them satisfied and involved. Visitors come for a wide variety of reasons, but mostly people are coming in with an attitude "what's in it for me", and want to leave feeling satisfied that they got what they expected. Particularly with interactive displays and activities it is important to incorporate a balance of reward and effort.

The arrangement of available space, distribution and style can be temporary or permanent. In either case the arrangement and circulation pattern, which is likened with an 'itinerary' must be clear not only to someone looking at the plan, but anyone walking through the spaces. Circulation should be planned to coincide with the logical order of the exhibit: governed by chronology, nature of materials, or a connected sequence of practical information.

### **Operational Issues.**

Over and above considerations for education content and spatial arrangement, there are a number of standard issues that impact museum design.

#### *Museum Fatigue*

A common problem with museum experiences is museum fatigue, or sensory overstimulation. Museums try to respond to this by incorporating areas to rest. An environment that contains too much information can lead to an uncomfortable feeling of over stimulation. In circumstances where a decision must be made this can lead to stress or confusion.

There is a fine line between novelty and pure stress. Piaget implies that children will prefer moderately novel events because these are the events that are most likely to be accommodated. Completely familiar events may be uninteresting to the child because they require no change in *scheme*, but completely unfamiliar events may be incomprehensible to the child because the child has no scheme into which to assimilate them.



### *Head count*

Museum operation is dependent on maintaining an audience. This means that a lot of emphasis is placed on drawing people in, keeping them there and ensuring they leave with a positive impression so that they are enticed to return and encourage others to do the same.

Unlike a school or playground, museums are a business and can only exist with admission fees and continued use. Therefore, there is a responsibility in design to ensure that the patrons want to come back, and that they will remember it and tell others about it.

### *Security*

Because people pay admission to the museum, there has to be a degree of control to ensure that some don't get in without paying. For an outdoor development this is particularly important as it determines how and where one accesses the outside and the degree of enclosure required to keep people from wandering in.

Additionally, security pertains to the individual safety of each individual. *Safety from abduction* is a critical consideration. Adequate viewing points for parents are required without always having to be involved in the activity thus giving the child some freedom but within safe limits. *Physical safety* ensures that the physical elements will not contribute to a child getting hurt or hurting others, either through the design of the elements or through appropriate monitoring of activities and places.

## **Children's Museums and Environmental Concerns**

With respect to environmental concerns children are often targeted as the key audience, because children's views seem malleable and we want to prepare them as stewards for tomorrow's environment. However, as mentioned already, we don't have the luxury to wait for these children to grow up and correct the environmental ills of their parents generation. As present stewards determining the fate of the environment every effort must be made to environmental attitudes and behavior. Sutherland & Ham recommend that more emphasis be placed on non formal environmental education program that target adults, and not to assume that adults are routinely reached by information presented to their children (Sutherland & Ham, 1992).

As an opportunity to focus on environmental issues, Children's museums appear to be an appropriate setting because they " . . . favor concrete over abstract learning, physical over

verbal interactions, experiential over conceptual understandings and sensory over theoretical."<sup>29</sup>

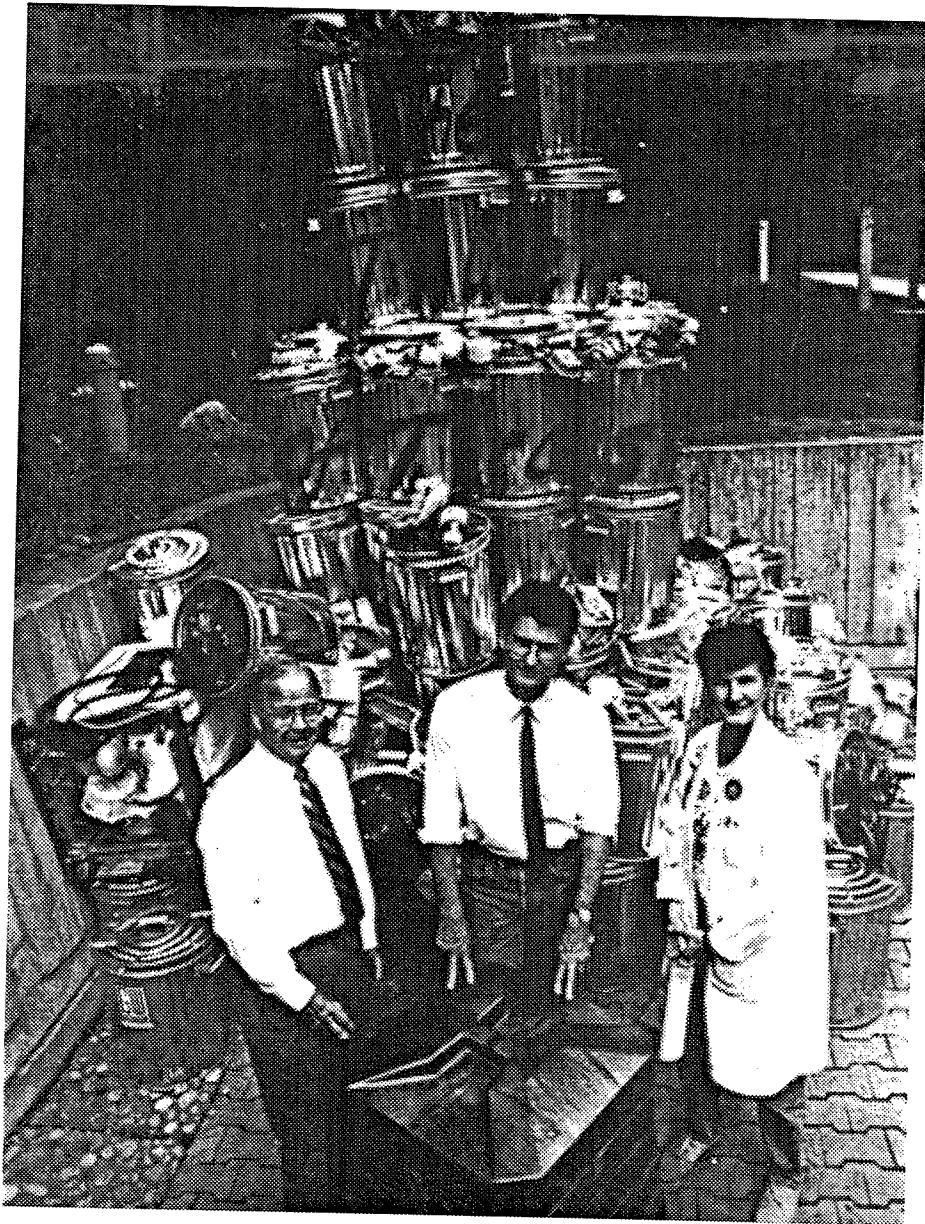


FIGURE 10: Tower of Trash: Presenting Environmental Issues through Exhibits - Shows the amount of garbage generated by one person in a year  
(Source: Fowle, p.72)

Based on information gleaned from various sources including discussions with curators and educational and exhibit coordinators from various museums, it is obvious that children's museums have recognized their venue as a positive source for education about

<sup>29</sup> Cohen, Stewart. "Fostering Shared Learning Among Children and Adults: The Children's Museum". Young Children. May 1989, p. 21.

the environment. To date most efforts have been concentrated indoors, however increasingly so exhibits and learning spaces are expanding outdoors with gardens, weather stations, etc. (see Figure 11). Some museums are located in larger park settings and promote exploration of the grounds in both formal (guided) and informal (self directed) way while others have dedicated whole environments to informing the public about the environment and mans place in it (see Figure 12). The exterior development adds an added challenge to the experience - uncontrollable weather. Thus many of the developments are intended to supplement the indoor experience.

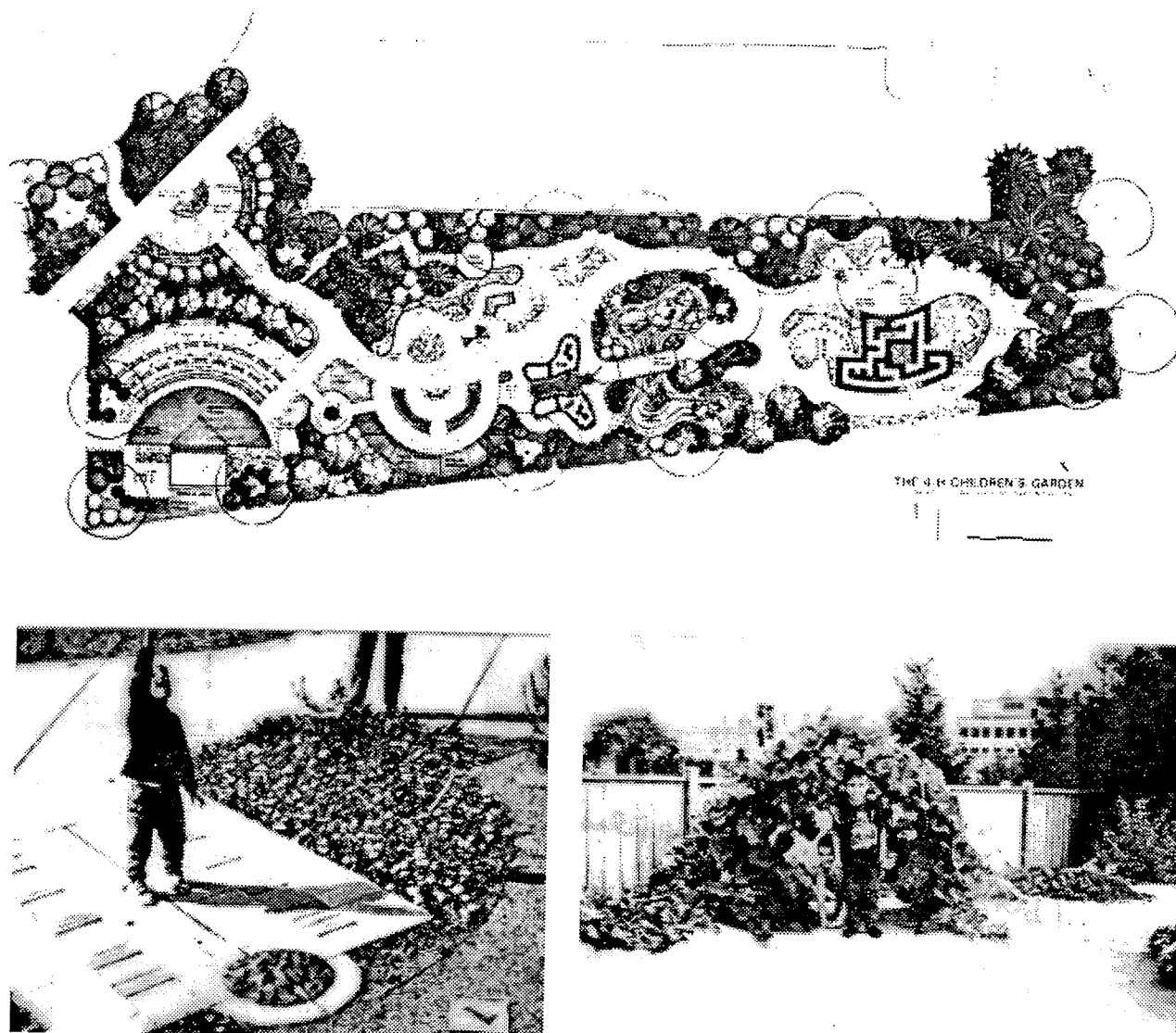


FIGURE 11: The Children's 4H Garden, Michigan State University - This is illustrative of the innovative kinds of outdoor spaces being created for children.  
(Source: Whiren, p. 252)

There isn't a great deal of information on applied environmental education approaches at museums. Therefore much of the research is based on programs and educational theories that have been developed within the formal education system. Research on methods, proposals, approaches, successes and failures within school systems serve as a basis for determining suitable content, educational rationale, techniques and direction for exhibits and displays.

Cohen and McMurtry state that a problem that exists in that the theoretical and conceptual basis for planning and design of Children's' museums is still in its infancy. As a result there is a lack of guidance. If such is the case for architecture, even less is available for landscape development.



FIGURE 12: The Urban Treehouse, New York  
(Source: Author unknown)

## Chapter 3.0

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# DESIGN & LEARNING PRINCIPLES

## *For Outdoor Experiential Learning Opportunities*

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*Principles and concepts produce a set of guidelines for structuring the educational environment into an interactive man/environmental learning system.*

## DESIGN & LEARNING PRINCIPLES

The physical environment affects the behavior and development of everyone, both children and adults alike, who live and work and play in it. The role of the designer in this project is to create an environment that helps shape constructive activities, reinforce an intended message, and do so in a fashion that is developmentally appropriate. To establish a framework from which to make design decisions the common aspects relevant to spatial and operational considerations for an outdoor learning spaces, have been distilled from the educational, developmental, and environmental concerns discussed in the background. These have been categorized as concepts and principles and represent those considerations which should pervade all stages of design.

### Exhibit Design Principles

The effect of the museum exhibit environment is more than just the learning activity or station. The overall impression, connection and linkages between activities, as well as the specific exhibit stations combine to create the learning experience. Perceptions, intuition and comfort levels play an important role in the success or failure of any message. The exhibit can take on a 'personality' of it's own that serves to entice and entertain. The components of the museum experience, individually and together determine how the environment is to be experienced. These categories are equally relevant to the outdoor experience, with a slightly different emphasis placed on the design strategies.

Design, therefore becomes a marriage of the technical details (exhibit and display specifics) with human interaction issues. It reminds us that the museum experience is as much about images and impressions as it is about movement through and actual physical involvement. Exhibit design constitutes the orderly planning and design of three components.

- i) Image
- ii) Circulation, and
- iii) Activities (exhibits/displays)

#### Image: ( theme, character, concept)

The image represents a composite of the tangible, visible and the symbolic portrayed to those who visit and pass by. The design of the 'grounds' should reflect the educational philosophy: an external expression of the hidden curriculum. A clear understanding of issues related to internal and external design is necessary to translate goals and the program into a form. Through design and planning the dominant image can be determined and supported by the overall experience. People react to quality, and prepare themselves for the experience based on their impression.

Internal image relates to user perception: the goal is to communicate and educate in a delightful, supportive and memorable environment. A level of complexity must be incorporated without overwhelming visitors, and allowing enough freedom for uninhibited play without trivializing the message. External Image pertains to perception upon approaching or of passers-by: this reflects the need to attract users, as well as enrich the urban milieu. Setting a mood that can be interpreted from afar increases visibility, attractiveness and presence. A positive self image which says 'the museum is important and is doing something worthwhile' is considered important in attracting volunteers.

### Circulation: Sequence of Experiences and their Staging

The layout of the site should do more than direct circulation, it can become the exhibit, part of the overall experience. The experience of moving through space and finding ones way are multi-dimensional and multi sensory. Paths should be delightful and mysterious with unexpected views, near and far, high and low. Discovery and exploration become tiring and frustrating when one has to rely on maps or signs or go through areas that are not of interest. Properly designed circulation patterns can avoid problems of fatigue and communication overload, which are concerns in the museum setting. Main operational issues include moving and accommodating as many people as possible, way finding, orientation, information overload and object satiation. The sequencing of the encounters will imply a hierarchy to the experiences. Decisions about the central path will set the mood and determine the overall experience and impressions.

### Activities: Exhibit and Display Components / Learning Stations

The interaction of people and displays is central to museum experience. Lasting impressions are usually based on meaningfulness of exhibits. Activities and displays are more than tools for educating they are the elements of the total environment that make a particular experience unique (Hayward, 1992). Focal points (objects in an exhibit or an activity area) can be powerful motivators for movement.

Humane and relevant experiences can be aesthetic, uplifting and inspiring. This implies that interactions must be more than just pushing buttons. The "real contribution to development and learning is the interactive display that activates many variables so that one is encouraged to think, try, analyze, make choices, synthesize and play roles. With these come learning and internalization, and besides, it's fun." <sup>1</sup>

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1 Cohen & McMurtry, 1985, p.35.

## Principles of Experiential Learning

Experiential learning is best facilitated by ensuring that the following principles are an integral part of the design response.

### Diversity:

Provide a diversity of experiences and encounters " . . . the broader the base of experience, the greater the capacity to learn. Diversity is the most fundamental principle for enhancing experiential learning."<sup>2</sup> Since learning constantly builds upon previous experiences and lessons it is understood that the more varied the opportunities the greater the breadth of potential knowledge. Diversity also caters to the differing learning styles, physical abilities, interests and intelligence of the visitor.

### Coherence:

Activities and experiences should be arranged "within a coherent framework or setting" to ensure some level of uniformity. "Experiences are more easily assimilated if related to each other in some orderly pattern. . . as diversity increases, the need for coherence among the barrage of stimuli becomes even more pronounced."<sup>3</sup> Coherence is the unifying element between the exhibits and experiences.

### Quality:

Everything should be carried out to the highest possible standards so that children feel that they are unique and worthy of this space designed for them.

### Involvement:

The most effective learning environments are involving, enticing, stimulating and challenging. Involvement in activities enrich the experience and bring new associations to link ideas together. Moreover, the possibility of involvement is an attraction, luring observers to become participants. Increased confidence leads to greater interaction and competence.

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2 Manning, Glen. The Educative Neighborhood: Theory and Principles for Enhancing Children's Experiential Learning. Thesis from the University of Manitoba, 1990, p.154

3 Manning, 1990, p.154



## Facilitating Experiential Learning in the Environment:

The following conditions identify a process of creating opportunities for experience and interaction: allowing for connections with the environment, attracting attention, encouraging exploration, providing reward, and a sense of competence in gained knowledge.

### *a) Connections*

To address the problem of the urban child's estrangement from the natural world, the first step should be to provide opportunities for direct interaction with the natural environment: a chance to reconnect is only possible through direct authentic experiences. Reinserting ourselves into the natural world and rediscovering feelings of humility and reverence for the planet is readily dismissed as too emotional, subjective or romantic. But, a harmonious association with the land is essential to learn how to interact with the physical world and to teach respect for the environment. When the process successfully entices interest and curiosity, continued experiences in the natural environment are more likely.

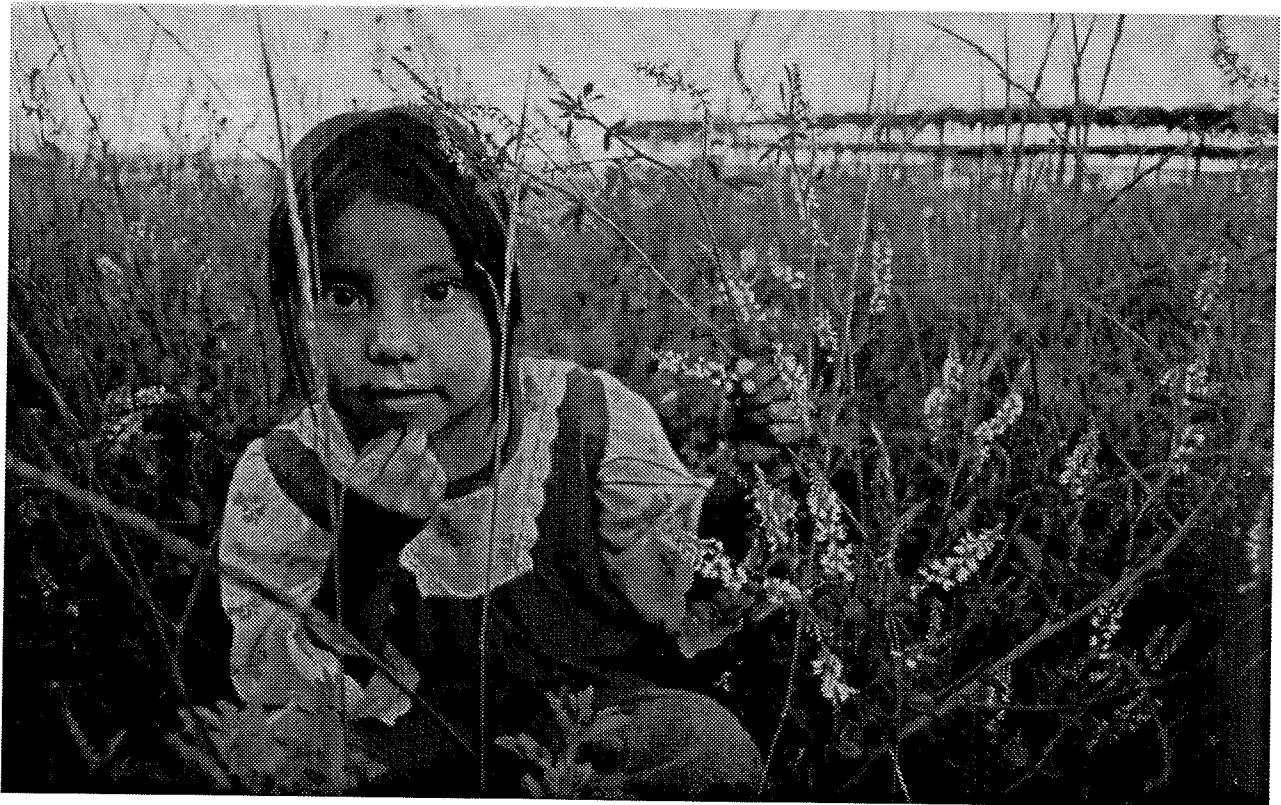


FIGURE 13: Reconnection With Nature.

(Source: Lorie, 1989, p. 70)

*b) Stimulate Curiosity*

Curiosity is the starting point of learning. It arouses interest and provides incentive to investigate the world by adding wonder, variety and intrigue. We are all fascinated by the new, intrigued by the mysterious and captivated by the challenge of learning and doing. Investigation is driven by an inherent 'need' to establish what something is, how it works and what is fun. Boundaries must be established to differentiate what is safe, dangerous, and who and what can be trusted.

*c) Qualitative Focus on Environment.*

The variables associated with 'sensitivity' are often not associated with formal education but are appropriate considerations in an outdoor experiential learning context. Research reveals that environmental sensitivity is a function of an individual's pleasurable contact with the outdoors either alone or with close personal friends or relatives, or as a result of an experience with severe degradation (Hungerford, Volk, 1990). Either way, recognition of the affective qualities of an environment, makes the experience meaningful and memorable:

"... for the child, and for the parent seeking to guide him, it is not half so important to know as to feel. If facts are the seed that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow ... Once the emotions have been aroused - a sense of the beautiful, the excitement of the new and unknown, a feeling of sympathy, pity, admiration, or love - then we wish for the knowledge about the object of our emotional response, once found it has lasting meaning. It is more important to pave the way for the child to want to know than to put him on a diet of facts he is not ready to assimilate." <sup>4</sup>

*d) Opportunities for Exploration and Discovery*

Exploration, an outgrowth of curiosity, is an investigation of the world, looking at new places and things. It is also seeing the old in new ways and, taking the time to pursue the answers to the questions that your curiosity raises. Exploration is doing: it's active, playful, dynamic (Herman et al., 1965).

Exploration can be both ambulatory (movement through space in search of stimulation) and stationary (inspection of a space or object that has already received a child's attention.) Each has different spatial requirements. Ambulatory needs ample space for movement, both vertically and horizontally, such as ladders, balconies and slides. Stationary exploration can be augmented by responsive environments. This includes undefined objects that are deemed more responsive because they have more opportunities for varied use and they provoke creativity and imagination: such as soil (mud pies) and water.

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<sup>4</sup> Carson, Rachel. The Sense of Wonder. New York: Harpers & Row, Publishers, 1965. p. 1

If emphasizing qualitative factors; they need not be 'ecological' but can consider relative characteristics. The exploration within imposed limitations, for example: "heat versus cold" can form the basis of later realization of "temperature as an environmental parameter." This could also include tactile experiences such as a prick of a thistle sting against the softness of a rose petal as comparison of adaptive plant characteristics (Hungerford, 1978).

*e) Promote Increased Knowledge*

Provide situations where discovery is based on fact and reality to substantiate ones feelings and intuition. It's important to 'see' the realities first hand since facts speak louder than theories - to give the child first hand "experience of a variety of simple interrelationships, and the relationship of structure to function, always emphasizing his own ultimate dependence upon, and responsibility for, other forms of life, and drawing out the wider environmental concepts whenever an opening occurs."<sup>5</sup>

*f) Encourage Sharing and Communication*

Provide opportunities which encourage the sharing of new found interests. Sharing is the affirmation of discovery, by sharing - the experience is enhanced. Sharing can often be difficult because it is risky. By sharing what is closest to your heart, you make yourself vulnerable and you risk not being understood. Yet it is in sharing that we grow in self-confidence and self-discovery.

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5 Herman, 1991, p. 87

## Chapter 4.0

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# DESIGN ISSUES & STRATEGIES

## *For Planning & Design of an Experiential Outdoor Environmental Learning Space*

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*A comprehensive design solution can express an attitude and a philosophy about the way the museum should be experienced. It is within the power of the designer to create a symbolic as well as concrete and tangible statement that is central to the life and activities of the museum.<sup>1</sup>*

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<sup>1</sup> Cohen, Uriel & Ruth McMurtry. Museums & Children: A Design Guide. Milwaukee, Wisconsin: Center for Architecture and Urban Planning Research, University of Wisconsin - Milwaukee, 1985. p. 12

## DESIGN ISSUES & STRATEGIES

The total environment has a powerful influence on how and what children learn. Designers must develop a sensitivity to the physical and psychological appearance of the surroundings. Colors, lighting and texture all contribute to kinesthetic and sensory awareness. The total visual, spatial, auditory and psychological messages that children receive from their environment must be considered to create a complete experiential learning environment.

The principles are the foundation or truth upon which issues develop and strategies are formed. The issues and the strategies contribute to, but do not produce a design. They provide a basis from which to plan and manage the design process. The issues refer to the specific areas of consideration, and the strategies identify design implications and learning methods used to address or achieve them.

The following issues and strategies were derived to guide the design of an enticing and engaging outdoor educational environment. A number of issues and strategies are inter-related, so some overlap and repetition of concepts exist; generally however, the application is different. These strategies are loosely organized to address the museum design considerations of image, organization and activities, in that they move from the broader range issues down to more specific issues of technical details.

### Issues for the Design of an Outdoor Learning Space <sup>2</sup>

- |                                       |   |
|---------------------------------------|---|
| 1. Context and siting                 | 7. Combination of varied interpretation & presentation styles |
| 2. Layout of spaces                   | 8. Realness   |
| 3. Range of social interaction        | 9. Clear accomplishments                                      |
| 4. Paced alternatives                 | 10. Environment & weather conditions                          |
| 5. Variety of three dimensional space | 11. Creating positive & engaging experiences                  |
| 6. Degrees of clarity & ambiguity     |   |

The complexity of organizing design strategies for an environmentally based exhibit is that it is difficult to separate the exhibit specifics (educational issues and concerns) from the design related ones (site planning, layout and learning station specifics). This is particularly complex when the environment serves as both the topic (lesson) and the setting (backdrop).

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<sup>2</sup> These categories evolved as a means of ordering the many strategies that came out of the background research, however four sources were critical to the final structure and content: Cohen & McMurtry, Moore et al., Manning, and Talbot & Frost.



Context and siting deals with locating the outdoor exhibit space, and is critical as it relates to public perception and visibility to passers by and to those visiting the museum. Siting is a function of program requirements, site opportunities and constraints, climate considerations and access to the adjacent facility. By providing public visibility, accessibility and positive contextual image, the siting of an exhibit can impact the potential rate of use:

I) Design Strategy:

- a) *Draw people in:* (both the paid visitors inside the museum, and those walking past) with a proven landmark or with the creation of a new one. Establishing a landmark responds to the notion of enticing participation, but it also denotes the creation of a prominent space. Establishing and reinforcing the landmark can be achieved by the placement of elements and symbolic imagery which are:
  - i) memorable and distinct features, or
  - ii) compelling & exciting activities



FIGURE 14: The Present Sign at the Manitoba Children's Museum - is an example of both a memorable feature and an exciting activity.

- b) *Determine the logistics of accessibility requirements:* Existing access points and connections between the indoor and outdoor exhibits are affected by the context. Infrastructure such as washrooms, shops, wheel chair ramps and other indoor amenities affect the layout for the outdoor exhibit.
- c) *Affect or impact environmental and weather conditions:* by providing opportunities to create sun catches, provide wind shelter, or ensure quick access to the indoors for sudden storms.
- d) *Relate to existing features, views, circulation patterns.*

## ii) Educational Strategy

- a) *Reinforce the message:* of environmental education as the exhibit focus. The subject matter can be related to the context which gives the learning environment a local presence and helps identify interpretive opportunities. In some cases context may not be relevant to the message. Here the environmental learning exhibit is set in a context the serves only as a backdrop. The setting may have to be buffered or isolated, with it's edge treated as a boundary.
- b) *Allow for a preview* by giving a glimpse of what's going on to passers by, to indoor museum goers, or from adjacent activity centers. These should provide clues to the qualities and content of the exhibits and can be further reinforced by the utilization of graphics or signage. A sign provides an introduction, which can trigger imagination, and graphics can provide symbolic suggestions of what's going on (intrigue). Graphics and signage also help to create linkages. On a more intimate scale the context can also provide glimpses into the exhibit space with sounds, colour and lighting. The contextual clues can be attained with a winding pathway and topography that peaks ahead to invite, intrigue and draw attention.  
A preview of the exhibit may be achieved by satellite displays in other areas of the Forks, and can provide lessons that elaborate further on a topic.
- c) *Identify contextual opportunities and constraints* afforded by the site. Where appropriate, focus on issues that are locally relevant and meaningful.
- d) *Potential environmental impacts:* consideration should be given to the potential impacts that any design imposition might have, since anything contradictory will undermine the intent of the educational program. The exhibit should not just be a lesson about the environment upon completion, but throughout the development process also.



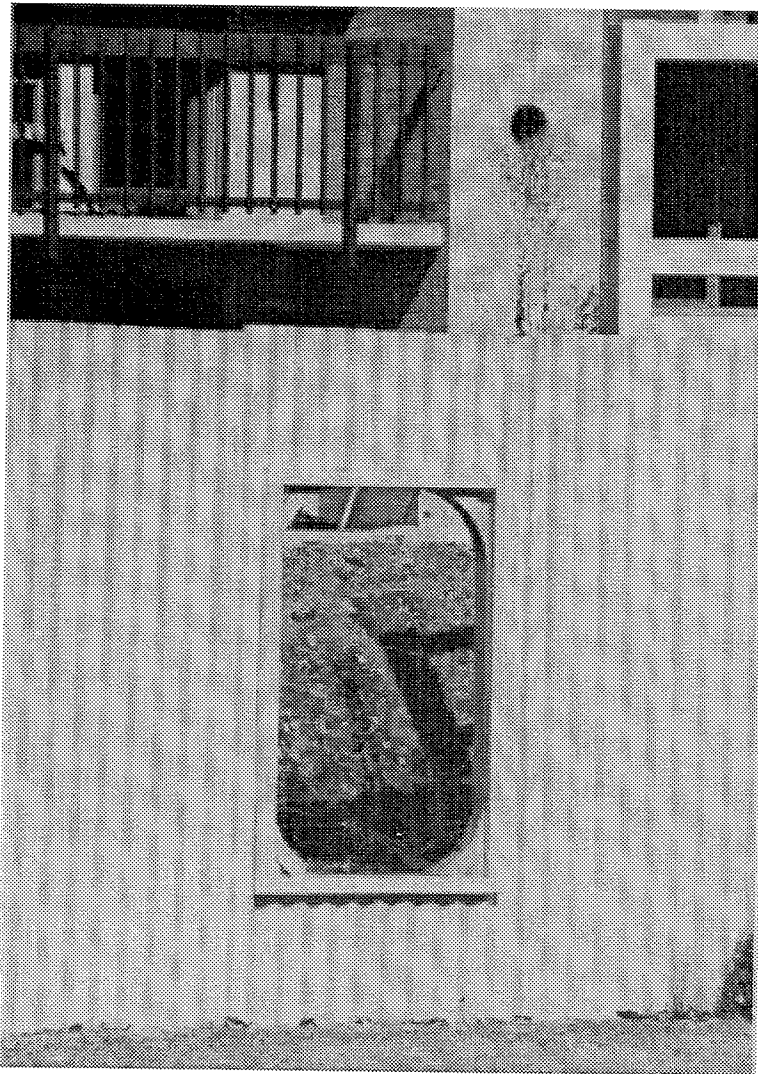


FIGURE 15: Windows or peepholes are one example of a preview.  
(Source: Barnard, p. 60)

## Issue 2. Layout of Spaces

The arrangement of activity areas is as important as the space or activity itself. The design must allow for ease of movement with minimal disturbance to other spaces and also ensure that spaces are well defined but not too enclosed. Well organized spaces invite desirable behavior. The proximity of adjacent activities, the connection between them and the traffic flow to, through and past them have a bearing on the experience. See Appendix C to determine spatial requirements for people outdoors.

The organization of activities or stations in an exhibit is a complex balance between site constraints, access, views, shelter in concert with the educational program or theme. It



also includes complementary support spaces. In conjunction with the practical aspects of site analysis, layout should consider the following:

i) Design Strategy:

- a) *Order, consistency and coherent distribution*: the placement of experiences along a route or in proximity to one another. Since our behavior is shaped by circumstances preceding, and situations in front of us, this involves considering not just the immediate experiences but the flow of activities around.
- b) *Variety*: the distribution of activities should balance order with novelty and excitement to prevent boredom.
- c) *Adjacency*: the proximity of one exhibit or activity to another should be based on a significant relationship, or where should try to shield noisy active areas from those that are quiet and passive.
- d) *Assembly*: Concentrate groups of activities and attractions which are too weak to stand on their own. Activities feed off one another to increase vitality exponentially. In general, a few concentrated pockets of intense activity are more successful than a widespread pattern of distinct attractions. However areas should still be simple and have limited operations. Eliminate any irrelevant stimuli.
- e) *Clear circulation and activities*: Circulation forms the thread which ties all the spaces together. Circulation patterns can create quality spaces for retreat, spontaneous meeting, variety and change.
- f) *Barrier free accessibility*: all transition spaces between indoor and outdoor should include appropriate space allocation to ensure barrier free accessibility.
- g) *Boundary treatments*: choice of materials and form of treatment impacts control over access and creation of a visual impact.
- h) *Zoning of activity spaces*. Order and comprehension can be gained by structuring activity spaces into zones. These may be based on any number of classifications but some common ones include activity types (ie: desk work vs. active play area), theme areas, and age or skills and abilities(preschool, school age).
- i) *Relationship to surrounding activities/amenities*: The degree to which the exhibit spaces 'fits' the context (physically and conceptually) determines whether to buffer or link, connect or protect.
- j) *Seasons*: bear in mind the impact of use through different seasons. Ponding water and drifting snow can change the quality and usability of the spaces. Since use is not always possible on account of weather, provide viewing areas from inside the museum, for observing natural processes.

## ii) Educational Strategy

a) *Allow the educational program and intent to dictate sequencing and layout of activities or stations such that:*

- incremental learning is reinforced with a linear sequencing of activities
- layered learning (where a topic goes from general to specific) is facilitated by a hierarchical sequence of activities by means of a primary circulation path with secondary branches.
- related elements are created by a more loosely structured space that allows for free movement between the activities.

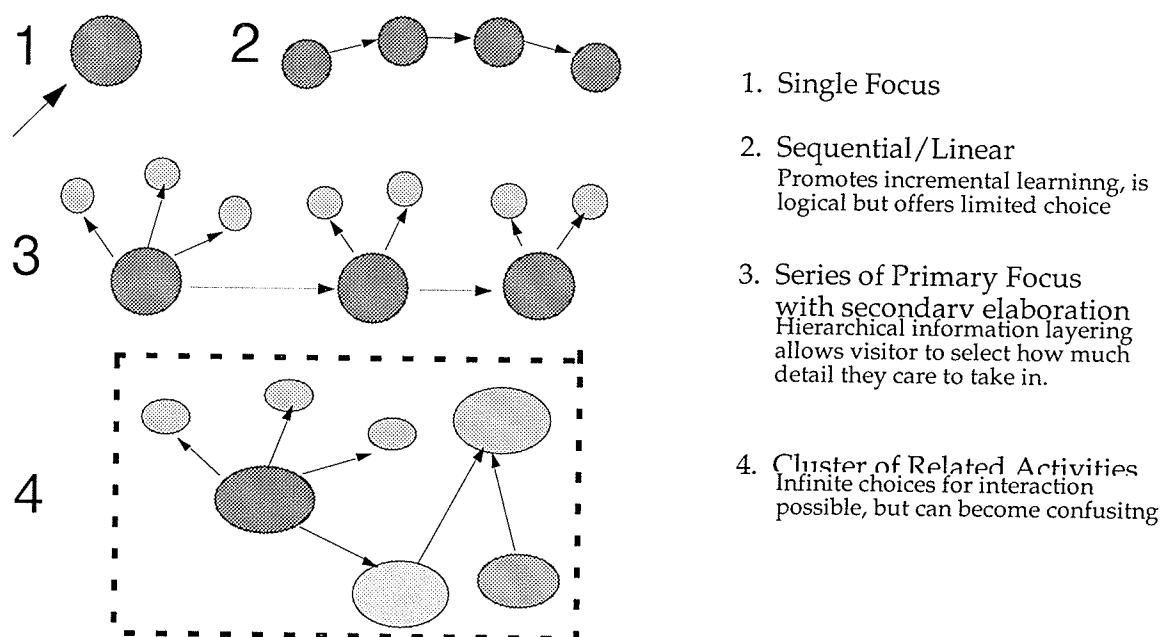


FIGURE 16: Optional methods for layout of activities.

b) *Options:* provide alternatives so that children have choices; this helps force choice and strengthen decision making skills

### Issue 3. Paced Alternatives

To challenge adults and children intellectually and physically a number of levels of information/interpretation and motivation - some complex, others straight forward and clear - should be provided. This serves to draw adults to look in more detail and children to begin to formulate hypotheses about things.

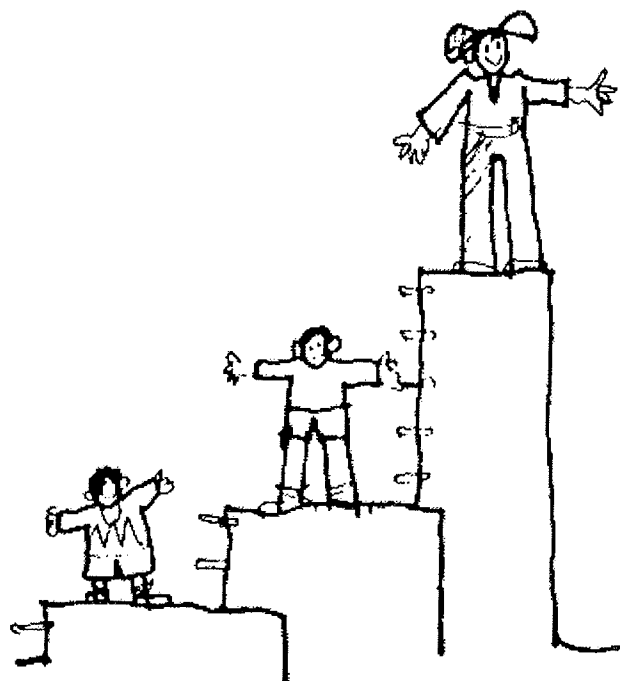
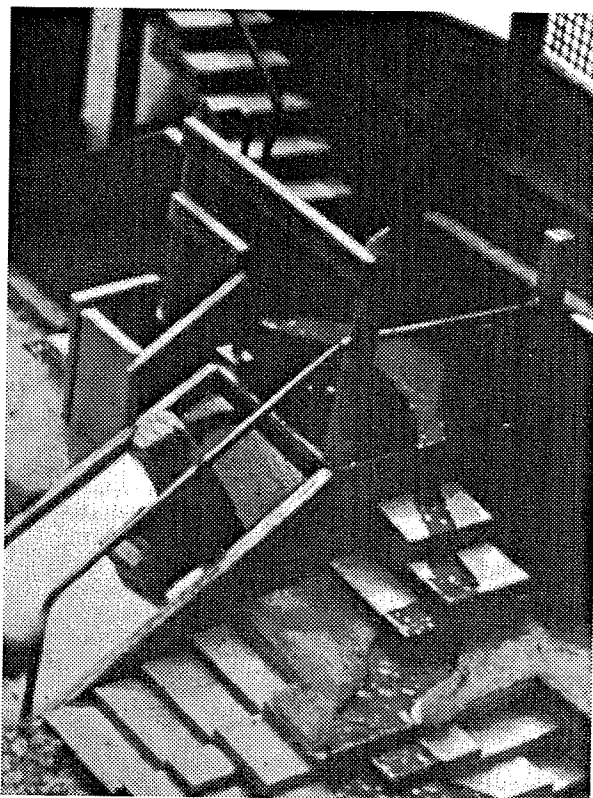


FIGURE 17: Example of Paced Alternatives - some physically challenging and others easy, but all lead to the same place.  
(Source: Moore et al. p. 58)

i) Design Strategy:

- a) *Layering*: Looking through things at other things The sense of depth is heightened and a feeling of richness is obtained. Discovery and mystery are enhanced because objects are often hidden by other objects and the child must move to see all parts of the environment. Sequential revelation or fragmented perception intrigues the imagination .
- b) *Variety with range of purposes*: flexibility and multiple use is encouraged
- c) *Regulate stimuli*: The rate, intensity and variety of stimuli which the visitor will encounter while exploring an exhibit refers to pacing. It is important to regulate the variety of stimuli by providing periods of excitement interspersed with opportunities to regain composure. The individual should be free to determine the amount of time spent at each station. As well if a need arises for orientation or explanation, excitement and sense of discovery can be lost if an individual feels that he is being processed along a conveyor belt.
- d) *Sun & Shade*: The quality and quantity of light and heat can dictate the types and intensity of activities that take place.

## ii) Educational Strategy

- a) *Incorporate different levels of meaning*: An object may have several levels of interpretation or degrees of complexity. These are discovered by the child over time, during each subsequent visit. Knowing that something new will be there next time
- b) *Sequencing*: the arrangement of level of information. This is intended for each age group in order that places and elements of interest to that group are sufficiently challenging to maintain interest without overwhelming them.

## Issue 4. Range of Social Interaction

A variety of places for different sizes of groups, to facilitate social and working relationships. Challenge, opportunity and even competition form a part of the seven to twelve age group experience. Friendly competition balanced with opportunities for results demanding cooperative efforts will encourage and stress cooperative play. The size of space as well as the type of activity taking place within it determines the degree of interaction between people.

### i) Design Strategy:

- a) *Varied spatial types and activity*: from large open space which invites rambunctious play to more intimate spaces that are conducive to activities requiring concentration and precise movement. Children are often more reserved indoors, so the outdoor areas should provide opportunities to run and jump, without interfering with other activities.
- b) *Space sizes*: The physical size of any space allows or limits the number of people who feel comfortable and can take part in an activity.
- c) *Forced interaction*: Various equipped exhibits should incorporate activities requiring two or more people to complete a task. Partnered activities help develop communication and cooperation skills.
  - private spaces nooks and crannies
  - two person activities
  - many person activities
  - activities with implied rules
- d) *Provide social opportunities that are varied, fun and invoke comfort and familiarity.*

Places for single children

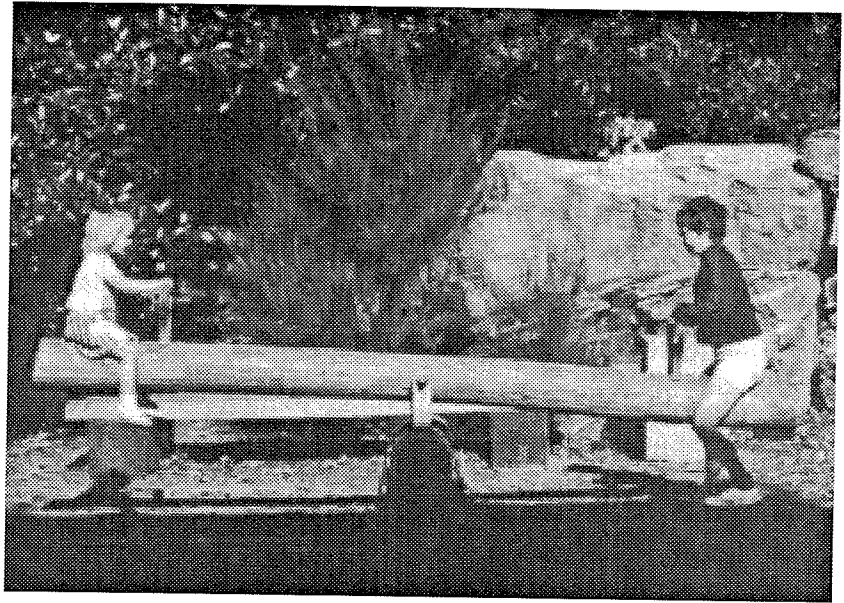
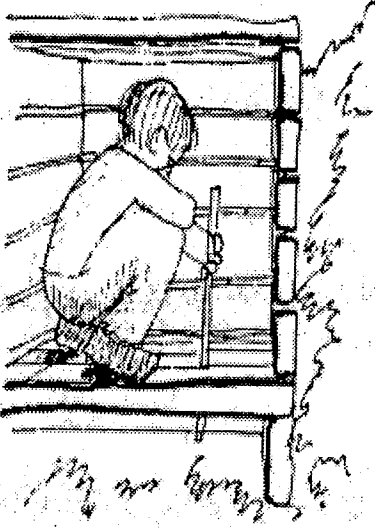


FIGURE 18: Range of Social Scale - left illustrating private places for single children, right showing activity requiring 2 people.

(Source: Moore et al. p. 51 & 56)

- e) *Provide retreats or rest areas:* to minimize concern over museum fatigue. These spaces can double as an unobtrusive viewing point for the visual learner or just provide quiet spaces for resting and reflection. Outdoors is often seen as the retreat itself, thus some quiet points, with benches and other informal sitting opportunities should be located near entrance/exit.

ii) Educational Strategy

- a) *Respect varied learning styles:* In addition to socialization, diversity of interactions serves the varied users and learning styles. Provide for three levels of experiences which will appeal to the varied individual learner types. Provide a range from static to busy:
- Calm/reflective
  - Active/observational
  - Energetic/playful
- b) *Adult involvement:* Environments should be planned to allow for varied degrees of adult involvement. This not only addresses desires of adults to participate in the learning process but considers the needs of the child learner.
- observe from afar: more supervisory, where there is no involvement and the child may even become unaware of the adult's presence.

- verbal interaction: observation from a point immediately adjacent, such that a conversation can ensue.
  - physical interaction: where the parent is actively involved and where shared learning is most likely to happen.
- c) *Provide adults supplementary resources* : to aid them in participating in the learning process and addressing environmental issues. Parents should be encouraged to ask leading questions, to listen to the ideas of children and respect any explanations offered. This will also help parents to understand their children by encouraging them to discuss and resolve any discrepancies between initial thoughts and new experiences. Parents should be reminded not to take the role of 'expert' with all the answers, but as partner or guide

### Issue 5. Variety of Three Dimensional Space

Senses are aroused by moderate variation in the architectural and structural aspects of the physical setting (i.e. size of physical space vs. size of objects in that space). Think of spatial experiences in all three dimensions as it affects movement and spatial quality. The quality of space is a result of the combined aspects of scale, size, shape, enclosure and continuity. Creating some contrasts (i.e. light or dark, noisy or quiet, warm and comforting vs. hard and sterile) evokes varied sensibilities.

#### i) Design Strategy:

- a) *Shape and size*: spaces which are all the same become monotonous. Variety in height to width proportions, colours and flooring provide a spontaneous stimulus. Spaces can range from angular and hard to curvaceous and soft flowing.
- b) *Organization*: monotony also results when a series of spaces follow one another in a straight line. A greater degree of intensity can be found in a dense clustering of elements of space "less is more" presentations. Important objects can be shown in isolation as focal points. Consider the impact of the arrangement: symmetrical/asymmetrical, dynamic /static, active / passive.
- c) *Changes of scale*: "Variety and change in spatial experiences - requires techniques in spatial modulation. The same design strategies can create a variety of experiences - intimacy, power, awe".<sup>3</sup>
  - a) miniature scale - the precious
  - b) child sized - just my size table heights, steps, benches doorways
  - c) the heroic, colossal scale

<sup>3</sup> Cohen & McMurtry, 1985, p.75

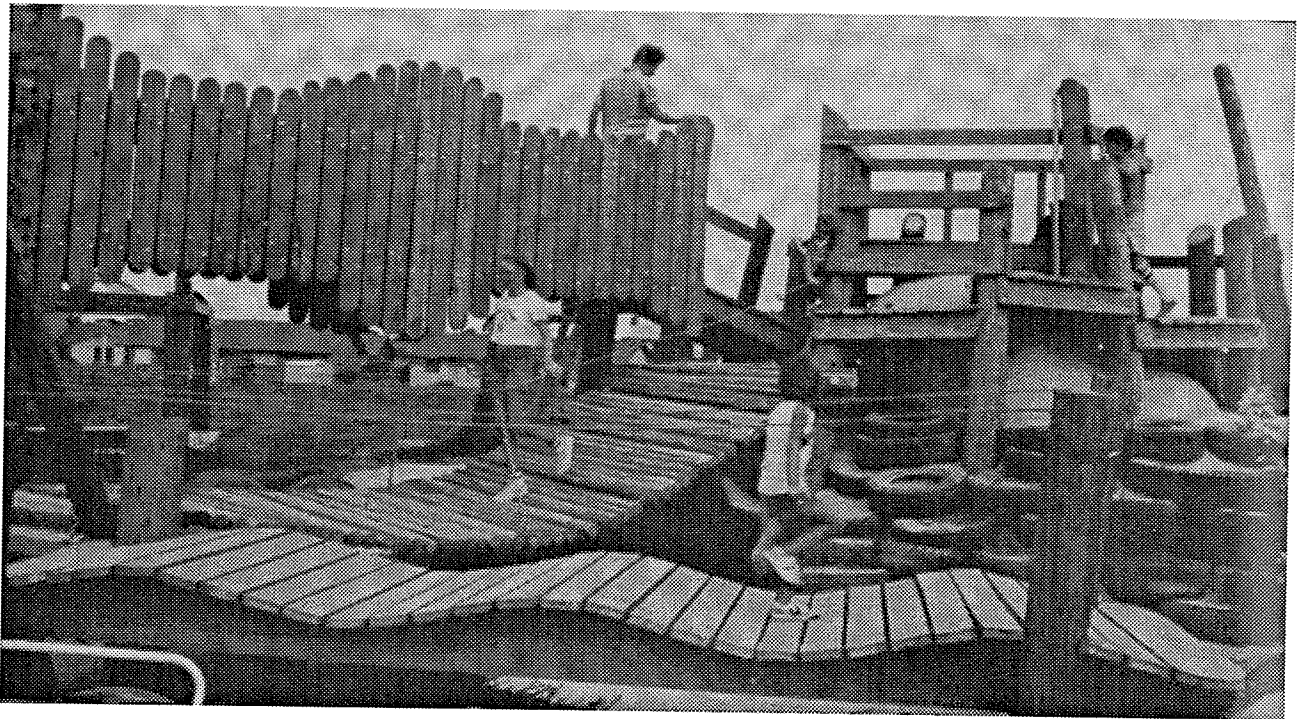


FIGURE 19: Undulating floor planes allow for novel kinds of movement through space.  
(Source: Talbot, 1989, p. 14)

- d) *Floor / ceiling height*: children are particularly attracted to up and down movement. Raised and lowered platforms, lofts, pits, climbing structures, mobiles, canopies, eaves, trellises or skylights allow for physical movement and exploration. High places, such as towers should provide views of surrounding activities.
  - e) *Sense of enclosure*: contrast open free spaces with enclosed intimate ones.
  - f) *Continuity*: the movement through a space to another. This can be actual or implied: by borrowing space free (visually) from the adjacent outdoor activities the eye can be drawn to other visual experiences.
  - g) *Fixed vs. flexible space* : Where feasible build in opportunities to modify the physical space. Flexibility and multiple use are important. Senses are aroused by moderate variation in the physical setting.
- ii) Educational Strategy
- a) *Varied miniscapes*: prevent boredom by enabling children to seek out activities and levels of stimulation to suit their moods at different points in the day.
  - b) *Develop spatial relationship concepts*: though not confined to a museum setting the juxtaposition of spaces and activities can help establish an understanding of such relationships as: near/far, open/closed, up/down, in/out to name a few.

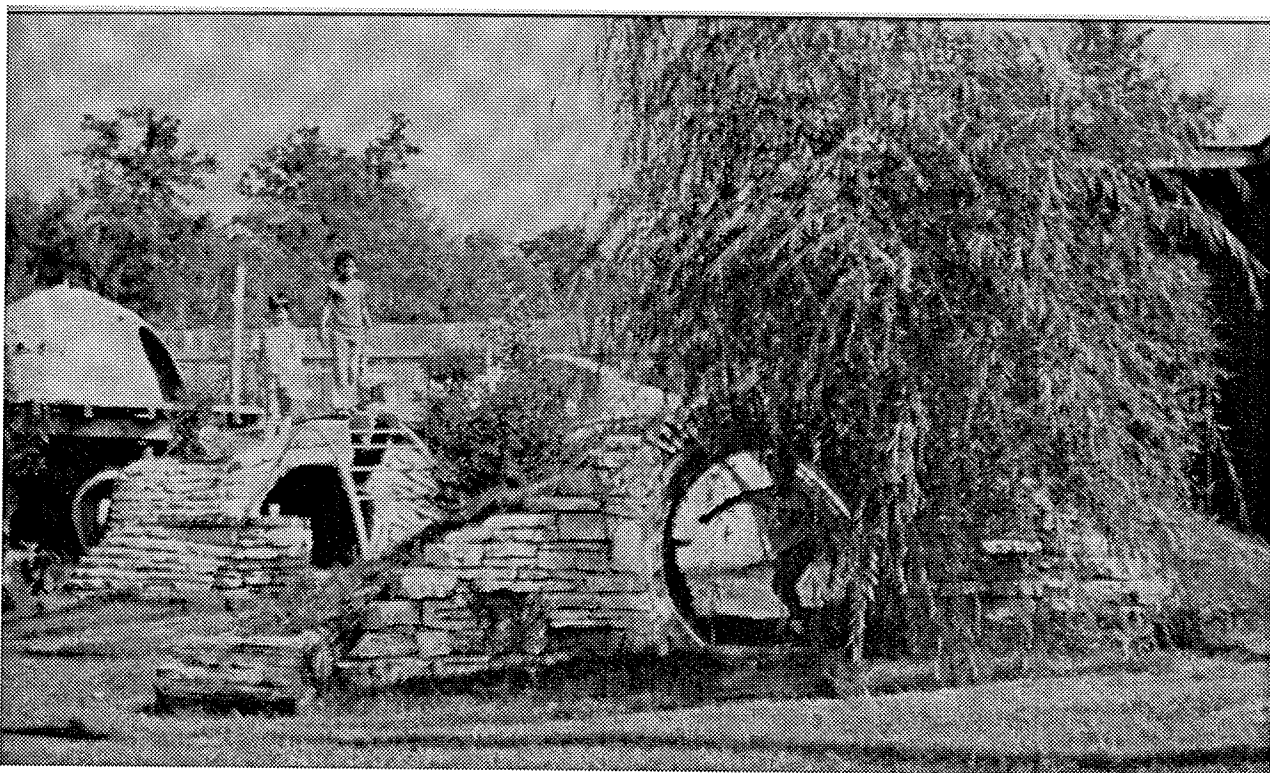


FIGURE 20: Rich, Varied Spaces: besides enhancing the play experience it also helps develop concepts of spatial relationships.

(Source: Talbot, 1989, p. 15)

### Issue 6. Degrees of Clarity & Ambiguity

The degree of definition of space and objects within it can impact how the spaces will be used. Clearly defined spaces provide a context for role play and fantasy, while more ambiguous ones promote creativity and imagination, (Moore et al., 1979)

#### i) Design Strategy:

- a) *Props*: provide props and structures that are ambiguous and able to become many things to children.
- b) *Ambiguity*: Introduce ambiguity in the relationship between objects or operations. This invites speculation and invention among visitors. Forms that are over designed tend to dictate meaning. Shapes whose meaning is not clearly defined lend themselves to more than one interpretation. The child then has the power to give meaning to it without feeling a need to be correct. Design should take advantage of associative qualities that provide clues to other meanings or interpretations (i.e. conical peak could represent a rocket, or a mountain).



- c) *Defined equipment*: include some defined equipment like water taps, pumps or fisherman's gear that can inspire role playing and pretending.
- ii) Educational Strategy
- a) *Noticeable difference*: juxtaposition of elements can be used to illustrate an idea; or draw attention to features of educational potential. To encourage questioning. "... the use of analogy and whimsy, humor and visual associations to make fundamental ideas, and in particular ideas concerning natural phenomena, accessible and compelling to a broad range of people. ..."<sup>4</sup>
    - Context mismatch: introduce some surprising mismatches (elements that appear out of place) to stimulate questions about relationship implications.

#### Issue 7. Realness (handling parts of the real world)

The real often has more impact for children than the implied; particularly with things like pumps and gears or objects that have moving parts. The more working parts something has that children can either control or relate to, the better.

- i) Design Strategy:
- a) *Real objects*: wherever possible, introduce elements that are genuine, not toys. This probably responds most directly to the principle of quality, as it says to the child that you trust them to use these elements properly, and they are deserving.
  - b) *Icons that are representative of the real world*: when it is not possible to handle the real object then a replica, with the same physical attributes and similar detail are the next best thing. This may mean a changed scale to allow use: enlargement of a mechanical device to illustrate how it works, or model of an object which is normally too large to see all the working parts, or fit into a setting.
  - c) *Usability*: ensure any barriers to use or operation are eliminated: this includes adding stairs or platforms, gripable handles, touch sensitive operators.
  - d) *Association*: objects with the greatest significance are ones that they see used by parents, and typically are not available for children to use: "same thing as mom or dad has".
  - e) *Affiliation and Identity*: incorporate elements that have meaning and significance to a child. These should also have a clear use and relevance to the activity.

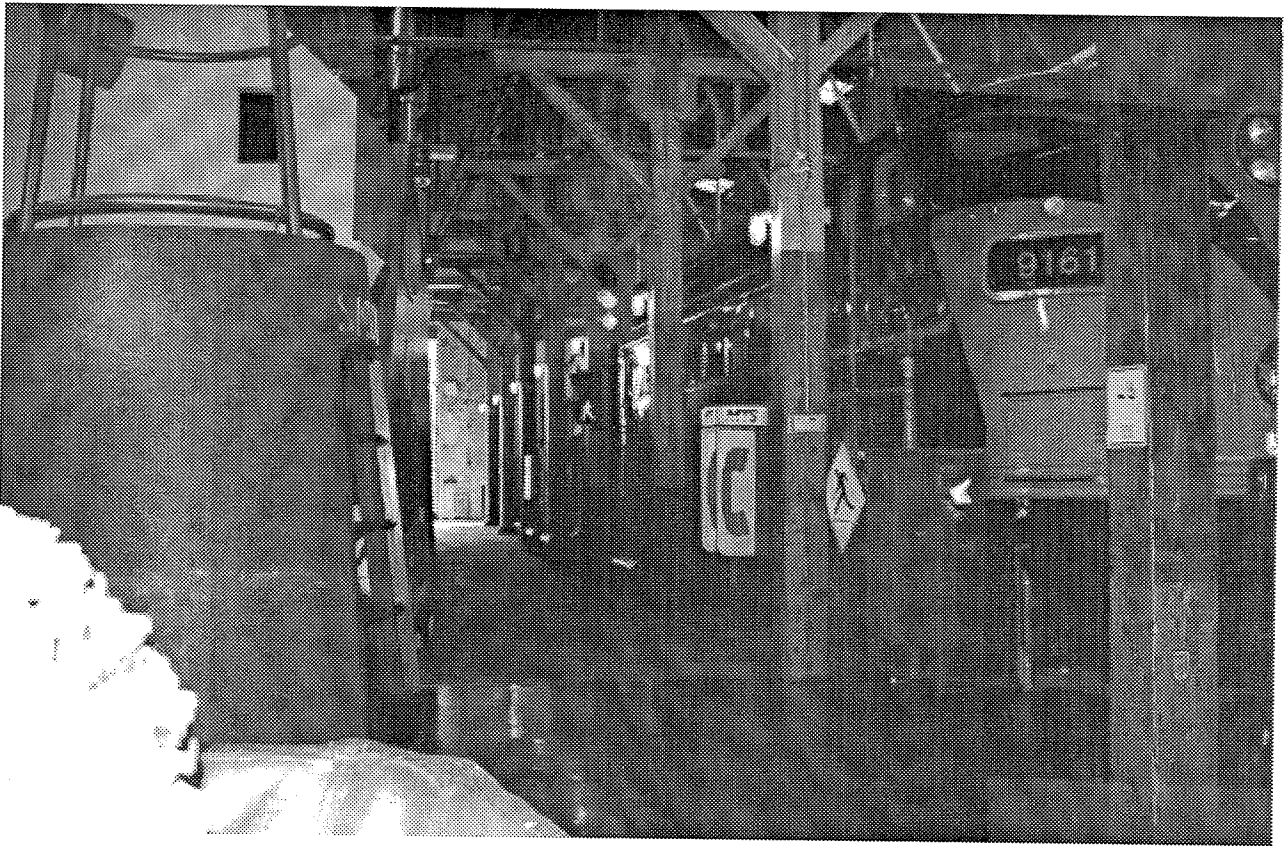


FIGURE 21: The Train at the Manitoba Children's Museum: the refurbished engine and dining cars complete with a two-radio system that hooks directly to the CN station - provides a sense of realism. This is further enhanced by items like the MTS phone. This is further enhanced by a phone booth and street signage.

## ii) Educational Strategy

- a) *Immediate relevance*: The exhibit focus should deal with concepts that hold some immediate relevance. Exhibits can enhance understanding of ecological foundations, provide an awareness of issues and can introduce a framework for the investigation and evaluation of the at hand issues.
- b) *Familiarity*: ensure some objects and materials are known to children, this is important in establishing a degree of comfort, which is imperative to enticing exploration.
- c) *Understanding of their immediate world*: by being able to manipulate real objects they have an opportunity to witness their impact on it. In the case of environmental education this further establishes what they can do to 'help'.
- d) *Loose Parts*: manipulative elements, particularly things like sand and water that are infinitely variable, and other objects that can be moved around. This allows the child to personalize or control how a space or activity is experienced.



FIGURE 22: Costumes and Dining car items in the Train Gallery - allow children to act like mom and dad, as well as manipulate the physical environment.

#### Issue 8. Combination of Varied Interpretation and Presentation Styles

Relates to learning styles and exhibit interpretive techniques. Is closely linked to range of interaction since the type of interpretation is dependent of the number of people involved, and serves to promote varied types of play or learning.

##### i) Design Strategy:

- a) *Sensory enriched*: Places that engage all the senses are more enchanting and remain more profoundly in our memories. Fluid or viscous materials like sand, dirt, clay, and water also engage the senses while enhancing the construction of symbolic play schemes.
  - color: use to enliven, differentiate, attract attention, soothe, activate. When carefully controlled, it can serve to reinforce non-verbal cues.
  - light/shadow: contrasting areas of darkness/brightness, pool of light effects movement and mood. Shadows can create interesting visual textures, as well as impact reflective qualities of water.
  - texture: contrast smooth and rough, hard and soft. Use to articulate distinct activity areas and circulation paths.
  - temperature: contrasting warm with cool: can be combined with color and texture as a basis for discussions on reflection and absorption.
  - auditory: contrast sounds of the city with sounds of nature.

- b) *Diverse*: introduce diversity to stimulate the entire spectrum of senses. But ensure experience does not conflict or compromise the coherence of the overall message or theme. Too much variety is as bad as too little.
- c) *Physically involving*: recognizes children explore in both quiet and lively ways and provides an opportunity to enhance both fine and gross motor skills. Techniques to attract involvement include, but are not limited to handles and buttons, footprints or hand prints to follow.

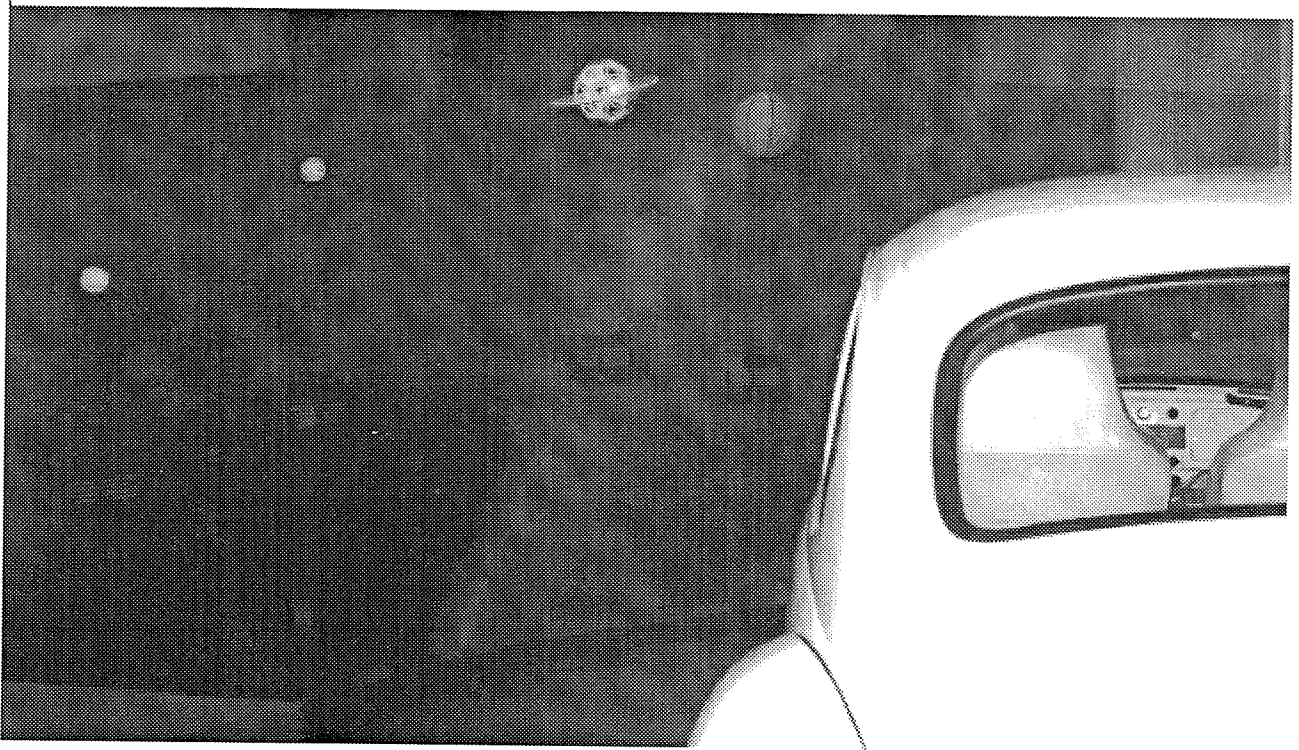


FIGURE 23: The Solar Gallery at the Manitoba Children's Museum - the car as a representation of the sun invites children to sit inside and push buttons.

- d) *Playful*: learning can and should be fun - incorporate humor or enjoyment where ever possible.
- ii) Educational Strategy
  - a) *Line quality, shape and brilliance*: children are more intrigued with a circle than a square, a curved line than straight. "Children relate more easily to softened edges and curves to anthropomorphic shapes, to eccentricity and whimsicality."<sup>5</sup>

5 Talbot, James, & Joe. L. Frost. "Magical Playspaces", Childhood Education. Vol. 66, No. 1, Fall 1989, p.15

- b) *Naming of parts or elements*: children are interested in being able to identify and classify pieces of their environment; this often begins as an interest in names, particularly of plants.
- c) *Mystery*: Fog or snow can transform a landscape into a wonderland. Children love surprises and discovery. They are intrigued by the unfamiliar. The mysterious is an integral part of life.

## Issue 9. Clear Accomplishments

Opportunities to explore and discover should be provided with self testing activities that allow a child to observe, plan, hypothesize, strategies make judgments and test ideas. This important to developing decision making skills and establishing confidence.

### i) Design Strategy:

- a) *Challenge without risk*: balance safety and supervision against challenge and freedom. This includes both physical and emotional risk. A child should never put into a situation where humiliation is possible: positive reinforcement is imperative.
- b) *Recognizable Success*: Children are so bombarded by things they cannot yet do, that it is important that they realized an accomplishment. This can be as simple as turning something on or climbing higher than they have before something. For environmental learning this is often achieved with growing plants or composting, It provides a sense of gratification and validation that further reinforces the desire to try or test new things.
- c) *Possibilities to display accomplishments to others*: This is similar to the idea of sharing learning experiences, therefor parents should be encouraged to interact or witness all activities.

### ii) Educational Strategy

- a) *Self testing activities*: opportunities to plan, hypothesize, make judgments and test ideas.
- b) *Accepting*: provide atmosphere which accepts the child as is with no pressure to conform. Recognize efforts by providing a sense of reward or non-judgmental feedback.
- c) *Possibility to fail*: while providing opportunities to achieve it is also important to permit the possibility of failure.

## Issue 10. Natural Forces and Weather Conditions

Seasonal changes offer both opportunities and constraints. Since the micro climate determines if and how a site will be used, issues of personal comfort must be address with respect to sun exposure, rain protection and wind control. From an educational perspective, seasonal variation provides an ever changing pallet from which to celebrate the natural environment and the cyclical processes.

### i) Design Strategy:

- a) *Control Natural Forces*: Introduce permanent and seasonal physical elements, such as snow fences and dams, to manipulate and control natural forces such. These have the dual purpose of illustrating another means by which man controls the environment, as well as create interesting snow drift configurations in areas visible from paths and provide wind protection
- b) *Understanding of climatic factors and conditions*: incorporating sun dials, shadow sculptures or masses of sunflowers to dramatize the path of the sun through the sky to reinforce the understanding of cardinal directions.
- c) *Adjust micro climate*: the overall affect can be manipulated through with plantings, berms, walls & trellises to increase comfort and at the same time provide secluded places of retreat to hide or rest.

### ii) Educational Strategy

- a) *Adaptation*: an opportunity to address concepts of adaptation, mans ability to manipulate the environment in sensitive ways to enhance his comfort level.
- b) *Incorporate devices that measure climatic factors*: incorporating anemometers, wind socks, thermometers, barometers, and other weather instruments, serves to make daily weather and seasonal changes more understandable and less mysterious evident by
- c) *Celebrate seasonal transitions*: Where possible identify opportunities to experience or witness the transitions between the seasons: this would include leaves turning color, snow and ice, ice breaking along the river in spring, puddles formed as a result of runoff, temperature variations through the year.

## Issue 11. Creating Positive and Engaging Experiences

Discovery begins with a spark of curiosity. The following techniques help to provide that appeal that can make something ordinary into something special, unique or .

i) Design Strategy:

- a) *Make exhibits artistic*: select imagery which is explorable, manipulable, or a catalyst for thought and conversation.
- b) *Novelty (the lure)*: The rare, special, unpredictable and incongruous are all things that intrigue the child. By stretches the limits of the child it opens the door for varied levels of interpretations. Novelty can alter and expand children's perception of their world. All living creatures have an instinctive tendency to explore (Miles et al, 1982). However, too much novelty can be boring, so personal control over the degree of novelty is what should be provided ( balance novelty with familiarity).
- c) *Archetypal images*: symbols and myths give life meaning and direction. Images and stories are found in all cultures. Our fairy tales (with their glass slippers, dragons and golden balls) abound with such symbolism. Certain images are almost universally common to children's art like the sun, circles and trees. We could greatly enhance the range of experiences taking place in our playscapes by conscientiously incorporating some of these shapes (Talbot, Frost, 1989).
- d) *Design for spontaneity/surprise*: should be open, inviting and non-intimidating to all who visit. The environment should promote imaginative play, and capture the imagination and attention of the users. This entice them to participate.

ii) Educational Strategy

- a) *Uniqueness and variety*: of ideas, message, and approach. Should complement and enhance other learning experiences within the city, but also offer an experience or learning opportunity that is unlike others. By creating a distinct identity repetition of ideas is avoided. A variety of spaces should be provided to allow access to active, busy operations, social interaction and quiet meditative environment. Spaces must challenge the senses, set moods, and encourage a variety of learning experiences and activities.
- b) *Comfort*: children engage in genuine exploratory behaviors when they feel comfortable and secure in their physical surroundings. An inviting setting entices young learners to play and stay awhile.
- c) *Sense of place by giving it a unique character*: For a place to be magical there needs to be a certain atmosphere, a degree of containment that serves to cut off the rest of the world. Enhanced by having a mood setting focus and ambiance.

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*PART B*

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## Chapter 5.0

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# CONTEXT & SITE ANALYSIS

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*"A respect for the and a belief in the potential of all children is the vision of the Manitoba Children's Museum. The Museum provides an interactive learning environment which nurtures the power of the imagination and the spirit of exploration and self discovery"*

In the spring of 1994, the Manitoba Children's Museum welcomed the public into its 'new' home in the old B & B building at The Forks, in the City of Winnipeg, Manitoba. The museum had expanded and relocated, acquiring in the process a new identity, a more prominent presence in the city and, for the first time, surrounding outdoor green space.

### **Historical Context - The Forks**

The Forks refers to the reclaimed land of the former CN rail yard behind Union Station at the historic junction of the Red and Assiniboine Rivers. It lies between the CN rail berm and the Red River, north of the Assiniboine River, in the midst of the City's core area. The site has been long recognized as a valuable cultural, recreational and historic resource within the City of Winnipeg. The confluence of the Red and Assiniboine Rivers was the site of the Red River Settlement (1812) and the site of Forts Rouge (1738), Gibraltar (1810) and Upper Fort Garry (1835). It was a key location in the development of the West as a center of trade, commerce and transportation. Although occupied by the railroad companies for most of the 20th century, The Forks has recently been opened for public enjoyment with the creation of the Forks National Historic Site and the Forks Market and Plaza. What began as 93 acres (37.64 Ha) of obsolete former East CN Railway Yard, with old track and decrepit buildings, has been transformed into an active public 'meeting place', the new center of Winnipeg (see Figure 24 - Site Location Map of Downtown Winnipeg). Five of the original (existing at the time of development) buildings have been retained, four of which have already been renovated.

The changing use patterns of the Forks has come to reflect society's changing attitude and respect for our natural waterways. Originally the river systems were the focus of settlements as the "front door" and primary transportation corridor. However, as industrialization took hold, and the focus shifted to the automobile and train, the significance of the local water systems waned, often being relegated to back alley dumping grounds: ignored and abused. Neglect was further impacted by the fact that the local waterways were not relied upon as a source of drinking water, thereby minimizing concerns over cleanliness.

The land holdings include 9 acres (3.64 Ha) of National Historic Park, developed by Parks Canada, and an 18 acre (7.28 Ha) area north of York Avenue retained by CN for development in conjunction with the rest of the site. The remainder of the site, under direct control of The Forks - North Portage Partnership, is designated mixed use which

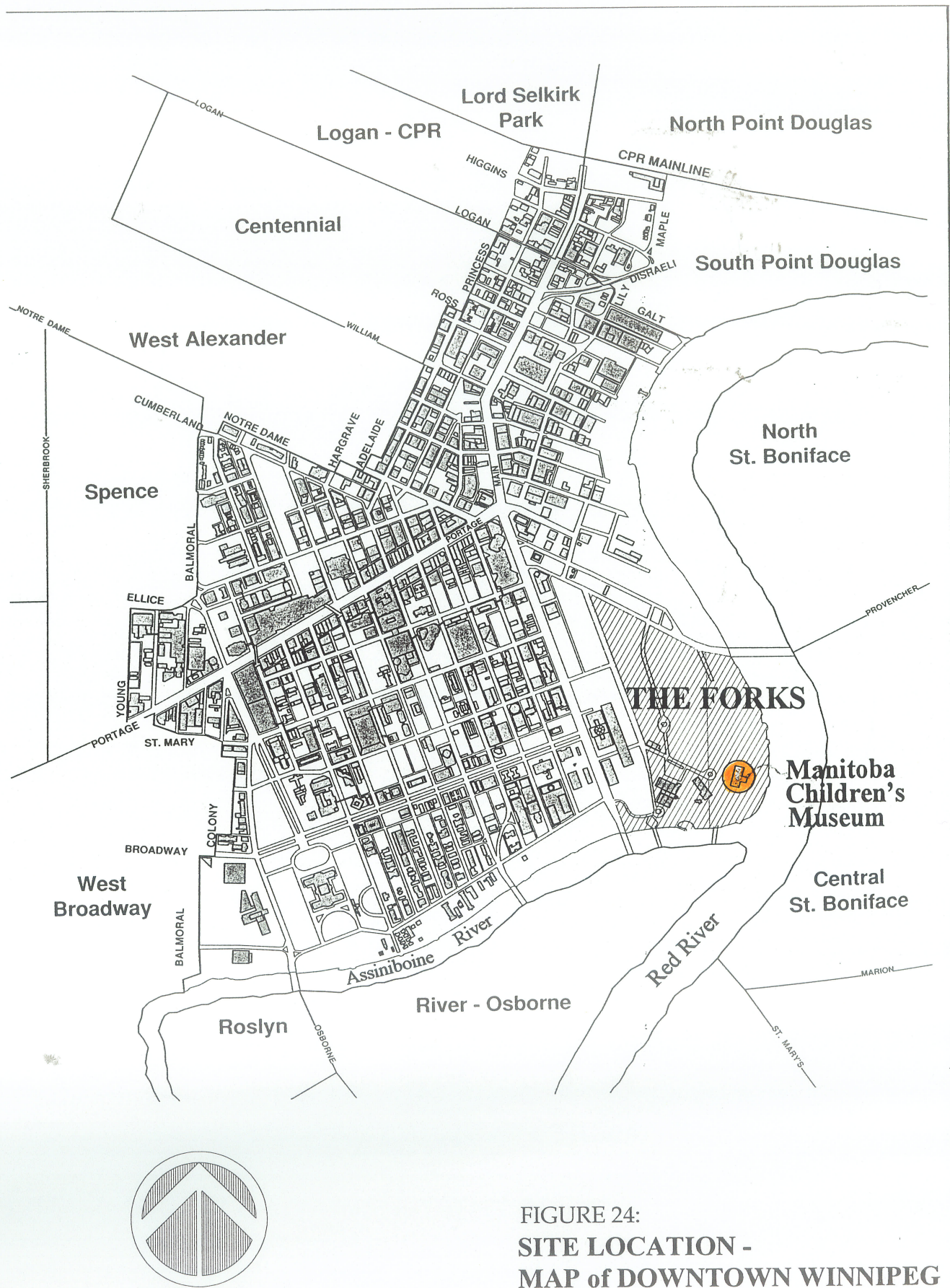


FIGURE 24:  
SITE LOCATION -  
MAP of DOWNTOWN WINNIPEG

Source: CENTRE PLAN Working Together for Winnipeg's Downtown, p.i

will include recreational, historical and cultural, residential and other commercial components. It is a valuable piece of land in Winnipeg due to size, location and history. In the wake of increased interest in our natural environment, the city's waterways, beginning at The Forks, have taken on a new prominence and significance, revered for their qualitative aspects and treated in a more ceremonial fashion.

An impressive list of annual festivals and events now take place at the Forks, and people from all over the city regularly congregate at the site for family picnics, recreational outings and to enjoy amenities like the Forks Market and the waterfront. Providing a vantage point of the railway tower, Union Station and the St. Boniface Basilica axis, The Forks has literally become the "heart of Winnipeg."<sup>1</sup>

### **Manitoba Children's Museum - History and Development**

The Manitoba Children's Museum has been a dynamic part of the cultural scene of Winnipeg since it opened in 1986. Since then it has constantly grown to accommodate increased content and programs. In June, 1986 the Manitoba Children's Museum opened to the public after four years of planning and development. It was and still is Western Canada's first and only children's museum.

Their first facility opened in a rented warehouse building at 109 Pacific Avenue and included 5000 sq. ft of space. It's first year drew over 65,000 people, the second highest attendance of all museums in Manitoba. The museum outgrew its space almost immediately after opening. In 1988 they expanded into another area of the warehouse, doubling their space to 10,000 sq. ft. In the late 1980's annual attendance increased to 141,000 visitors. As a result of this phenomenal growth, Phase Three planning began, as a larger facility was required to meet their needs.

It most recently underwent its third major expansion, which included a relocation from their first home on Pacific Avenue to the "B & B" (this is said to be an acronym for either "Buildings & Bridges" or "Bridge & Boiler") Building at The Forks. One of the reasons for the choice of site was the opportunity to capitalize on an outdoor environment, which was lacking at their previous location.

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<sup>1</sup> From Children's Museum Folder:

The B & B building had been recognized as an historically significant structure at the Forks due to its age and the important part that it played in the early rail development of the Forks and the province as a whole. It was structurally unsound and extensive work was required to retain the character of the original building in the redevelopment. In plan it is 'T' shaped with the original structure running north-south. An annex was added later, jutting out to the east.

### Programs, Philosophy and Mandate

The aim of the Children's Museum is to provide a hands on learning experience for children between the ages of 2-13 years. Its purpose is to teach children more about themselves and the world around them through interactive learning opportunities. Their revised Mission statement is:

"A respect for and belief in the potential of all children. To provide an interactive learning environment which nurtures the power of the imagination and the spirit of exploration and self-discovery."

Their objectives are:

Educational - respecting the ways in which children, and for that matter adults, learn best.

Cultural - as a beginning experience, where they can be introduced to arts, humanities and science.

Social - intended to be a nurturer of adulthood yet to come. A specific aim is to serve the children from the inner city who may have little or no access to intellectual or cultural enrichment.

Recreational - a place where people come together to laugh, play , and the child reigns supreme. Visitors are to be both entertained and informed. Active participation is important.

Economic - significant impact on tourism. Attention drawn to the museum favorably impacts the surrounding businesses and vice versa.

### Interior Exhibit Space Programming

The exhibit space is on one level. A small mezzanine has been constructed over the administration area to maximize the amount of exhibit space available.. The north side houses administration; the south side is bisected by the train gallery with the west



dedicated to support space, comprised of a gift shop, office and resource center; and the east to gallery and multipurpose space (See Figure 26).

Every opportunity has been taken to maximize natural light into the museum and views out. An arcade of windows 3'x12' run along the perimeter of the building, with the exception of the south side where two of the old train entranceways were entirely glazed (12'x16'). The third entranceway is taken up by the train and the fourth has been closed off.

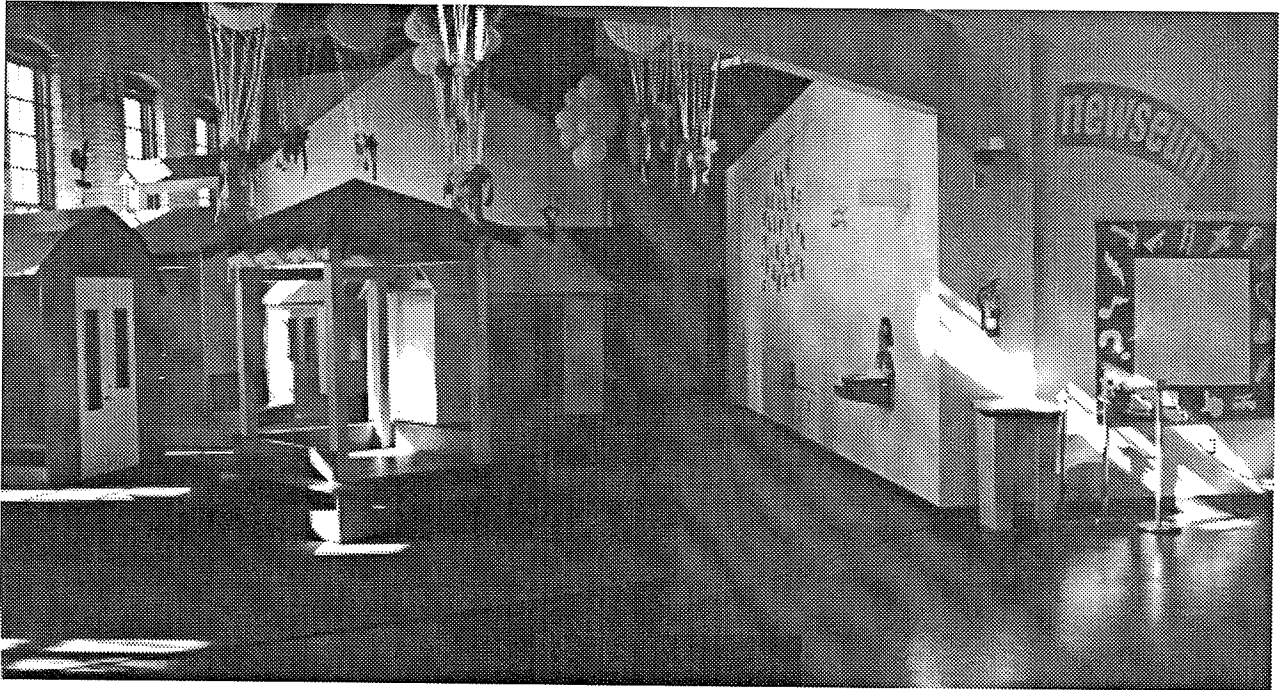


FIGURE 25: Character of Museum Interior - Foyer

### The Museum's Commitment to Environmental Concerns

The Manitoba Children's Museum has demonstrated a commitment to addressing environmental issues in their new location. Not only do they have a gift shop "The Elements of Nature" with a decidedly environmental focus, and run numerous programs that focus on the environment, but they have developed two permanent signature galleries "The Tree & Me" and "The Sun".

The Tree & Me Gallery is a tree designed to expose children to sites and sound found in nature and help them realize the importance of trees to people and many animals. The tree itself is a strong symbol of nature to many small children; it is familiar, and, it is what

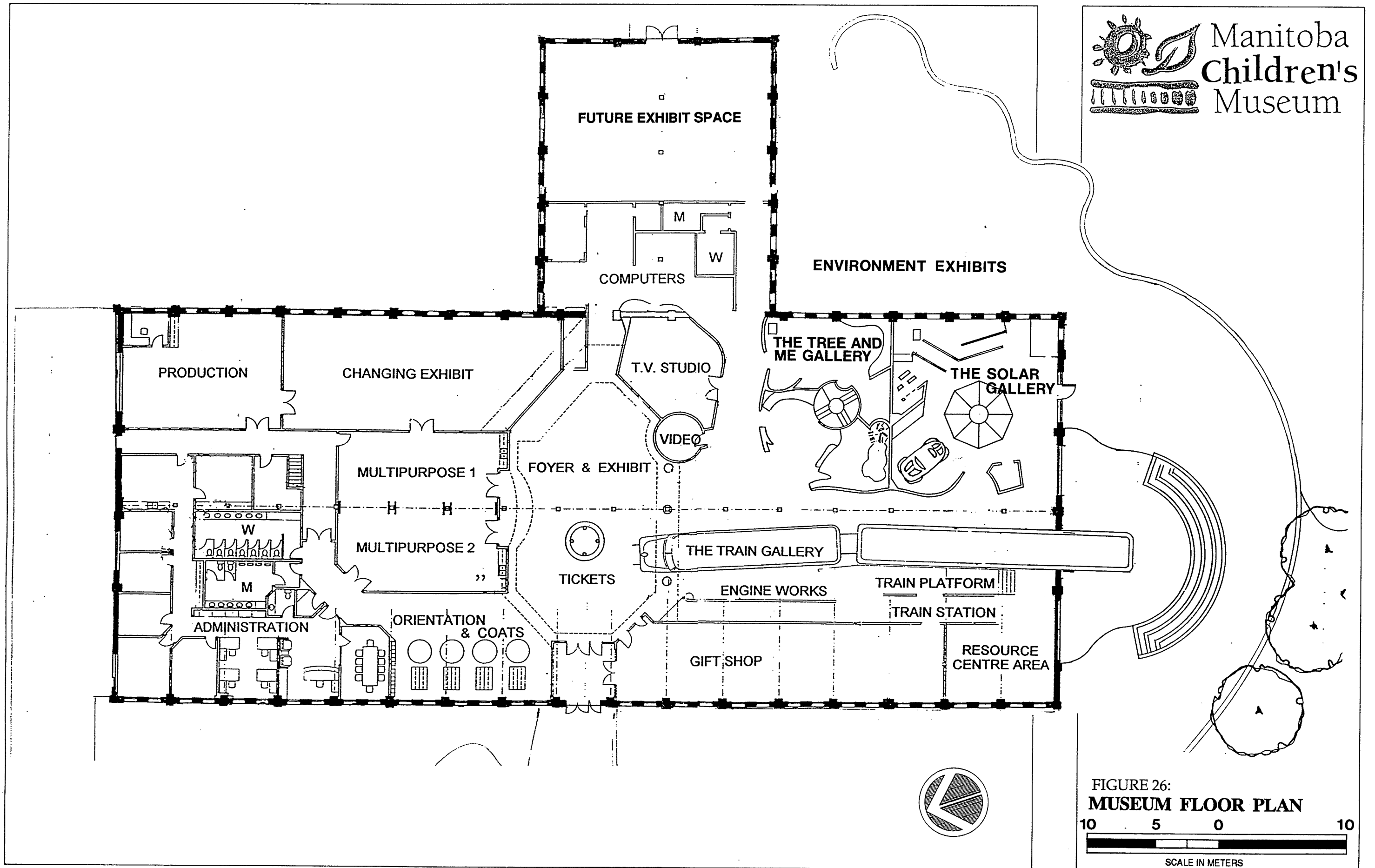
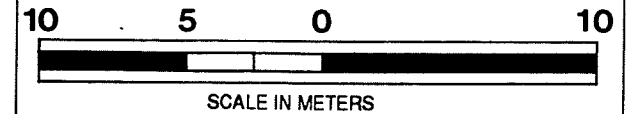


FIGURE 26:  
**MUSEUM FLOOR PLAN**



climb the tree from the inside. At the top of the tree peepholes provide views into various animal habitats and slide from the lookout platform takes them back down to the “forest floor” and a “meadow” beyond in the flat open area in front of the tree by the gallery entrance.

The Sun Gallery incorporates exhibits which demonstrate the physical aspects (scientific and cultural) of the sun. Playing on children’s ability to comprehend size and quantity through comparison, the sun gallery features a bright yellow Volkswagen and a variety of balls to represent the planets. From inside the car one can push buttons to discover interesting facts about the sun and its relationship to the Earth.

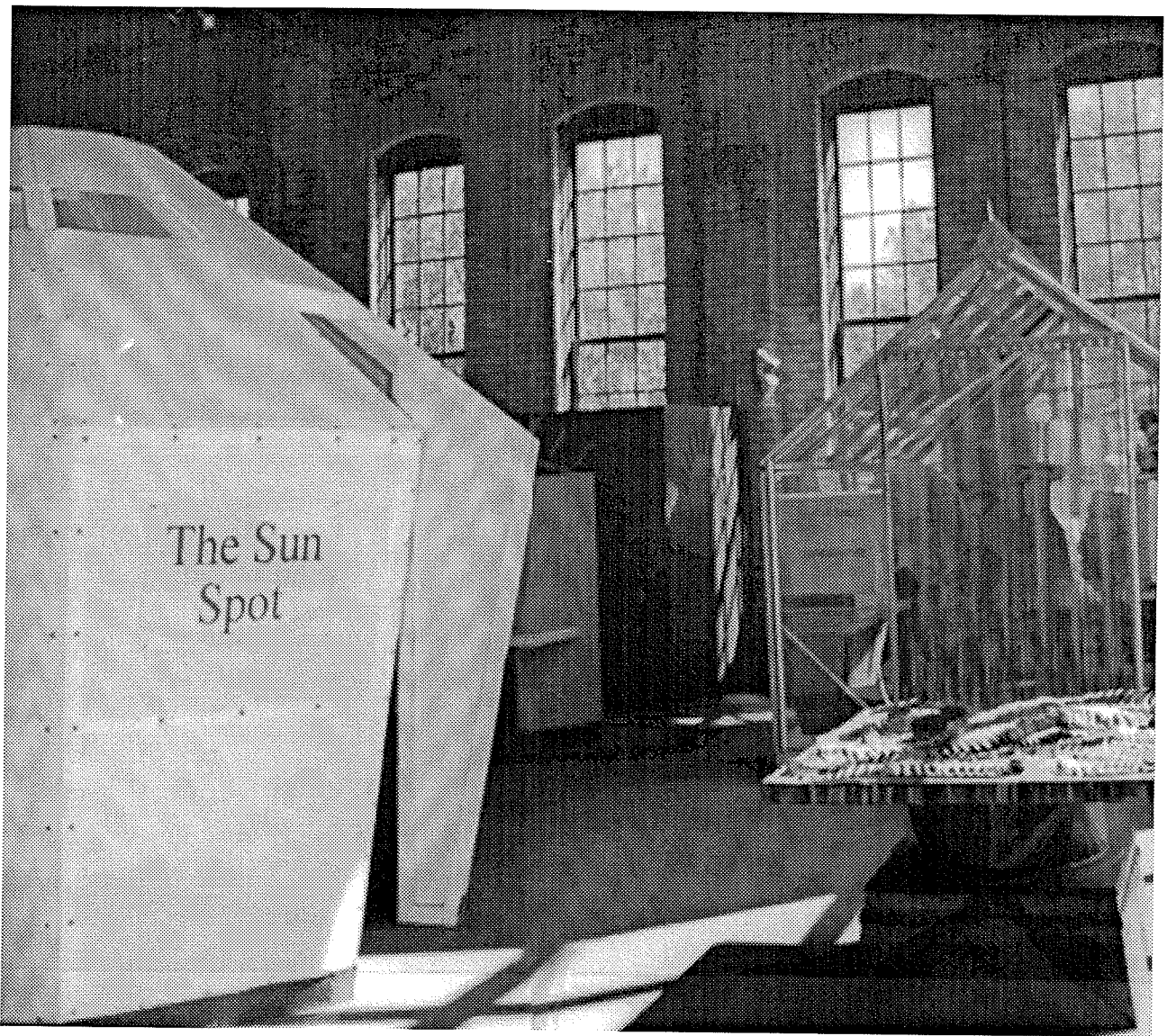


FIGURE 27: The Sun Gallery Space at the Manitoba Children’s Museum



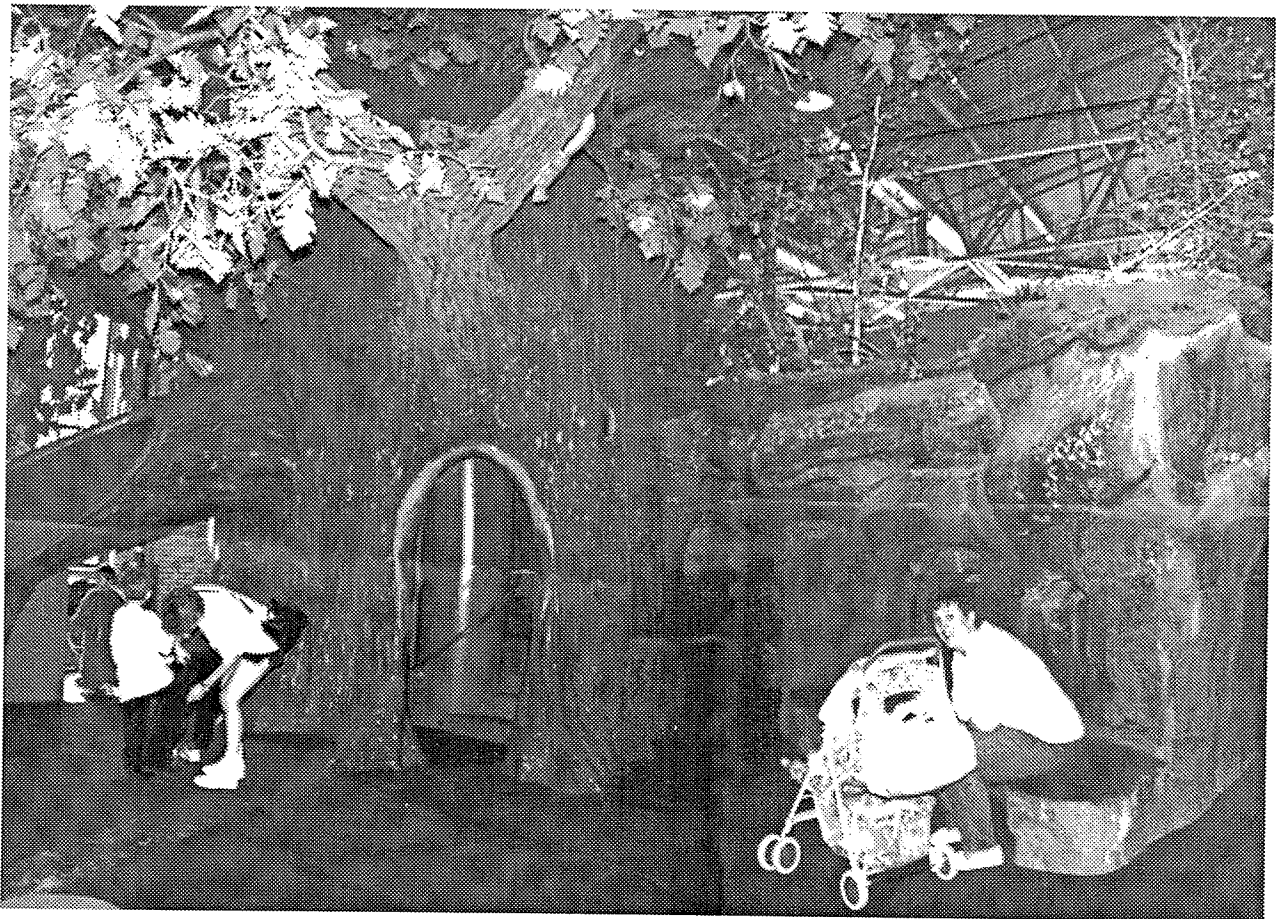
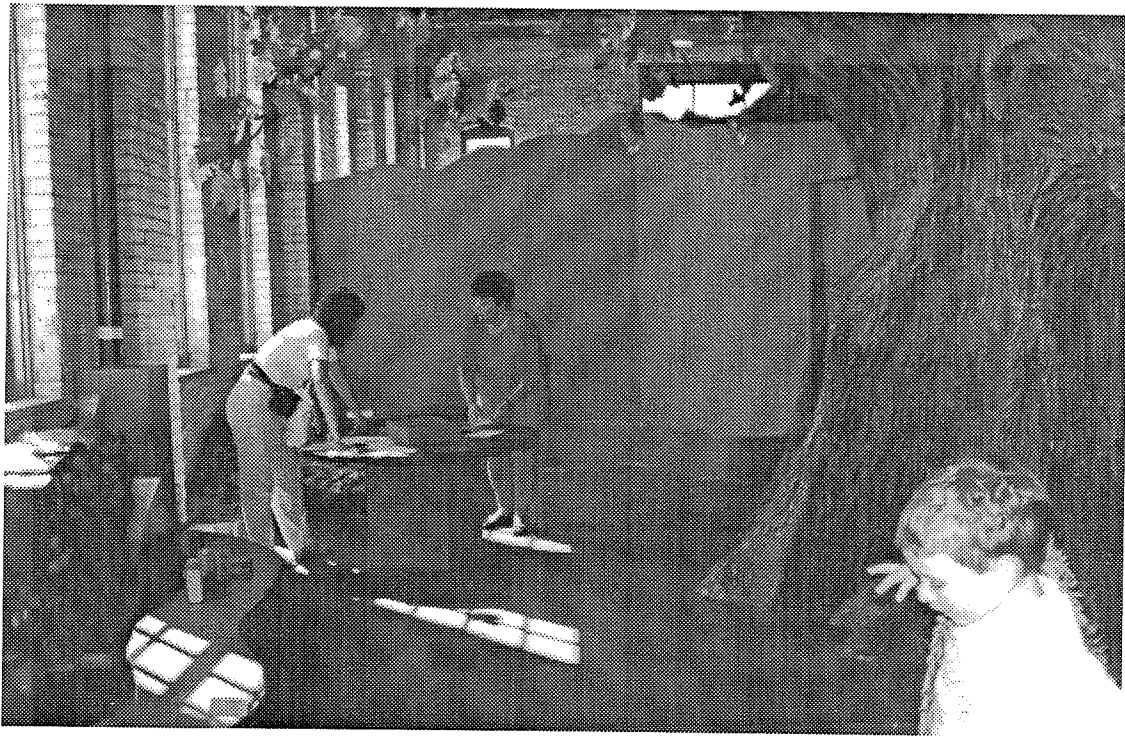


FIGURE 28: The "Tree & Me" Gallery at the Manitoba Children's Museum

## Site Inventory & Analysis

### Site Context

An unique aspect of The Forks' context is its proximity to downtown. There is a dichotomy in the perception of The Forks. On the one hand it has a very urban character and presence adjacent to high density housing and the downtown amenities of the city. On the other hand the rail yard and raised rail lines cut it off physically from the immediacy of urban activity. Together with the high profile, the river, walkway and extensive open space, it has a natural, park like feel about it. The Forks has been described by Val Werier, a local journalist, as "an enclave. . . so close and yet seemingly so far." <sup>2</sup>

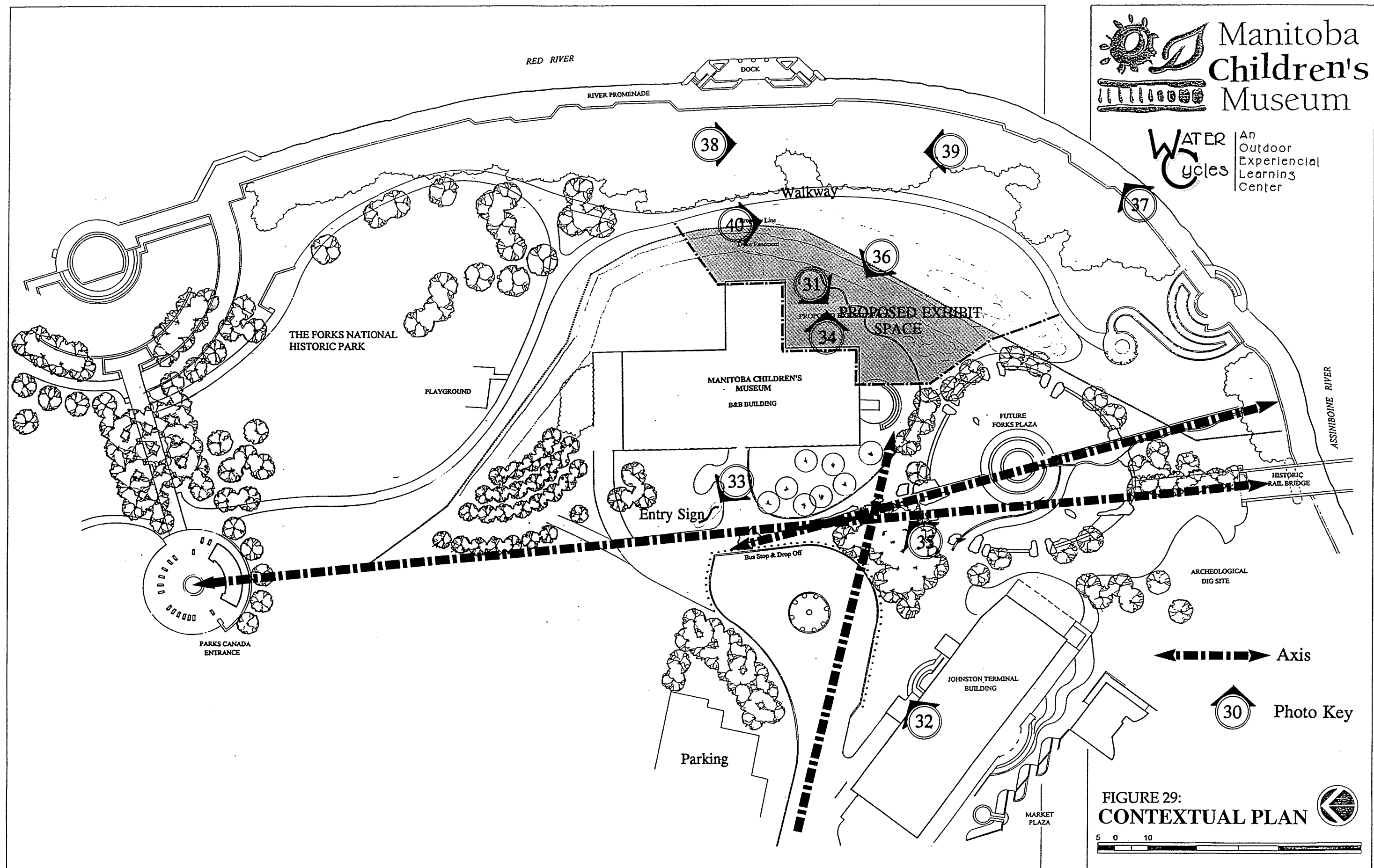
The museum site lies closest to the riverbank, east of the Johnston Terminal building just up the bank from the central dock along the Riverwalk. The Museum is outside the edge of the Forks National Historic Park property. It is situated in a prominent location axially; just east of and fronting onto the axis line between the center line of the Historic Bridge and the Historic Park Entrance Plaza. It also lies north of a center line projection of the Forks Market Road, which culminates in a turn around immediately in front of the museum entrance.(See Figure 29 - Contextual Plan)

The future Forks Plaza will be situated immediately south of the museum. Its north-south axial feature wall creates a sight line that focuses on the tip of the South Point and extends to the north, ending at a sculpture directly opposite the museum's entrance (see Figure 28).

The museum property is defined by roadways, walkways and fence lines: service entrance and loading dock to the north; traffic turnaround and bus drop off to the west, and a post and chain link fence to the east, beyond which is a berm and crushed limestone pathway, edged by the upper tree line of the river forest. Beyond the forested riverbank is the flood plain terrace and the Riverwalk /promenade at the waters edge. An eight metre wide strip that encircles the museum on the east, just outside the Parks Canada property, is presently being used as a construction road and serves as a flood control easement. As shown in Figure 30 - Site Analysis, the entire area between the building and the river to the east is being considered a usable site for the purpose of this study.

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2 Val Werier, "Forks Park gives Winnipeg a New Dimension", article taken from Vertical File Architecture library - no date cited.



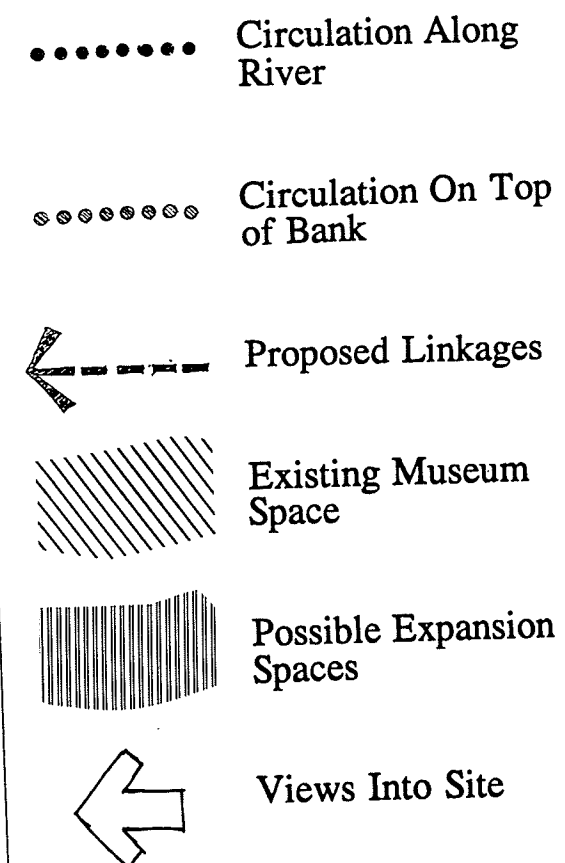
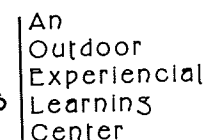
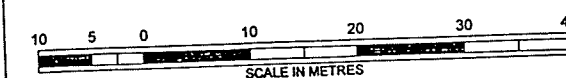


FIGURE 30:  
**SITE ANALYSIS**



Presently 'un-programmed' green spaces remain on the east on either side of the annex area, and to the west in front of the museum. The south is presently used to accommodate the section of the train which extends outside the museum building, and serves as a stage for small performances. Audience seating is provided by a small (140 child capacity) three-tiered amphitheater which is built into the grade opposite the train. To the north outside of the museum property, on the other side of the service road is a transportation theme playground.

A prominent feature to the museum is the newly installed 'character' fence. It runs from the front entrance and winds south, around the amphitheater and towards the annex (see Figure 31) defining a limit and priority area for outdoor development.

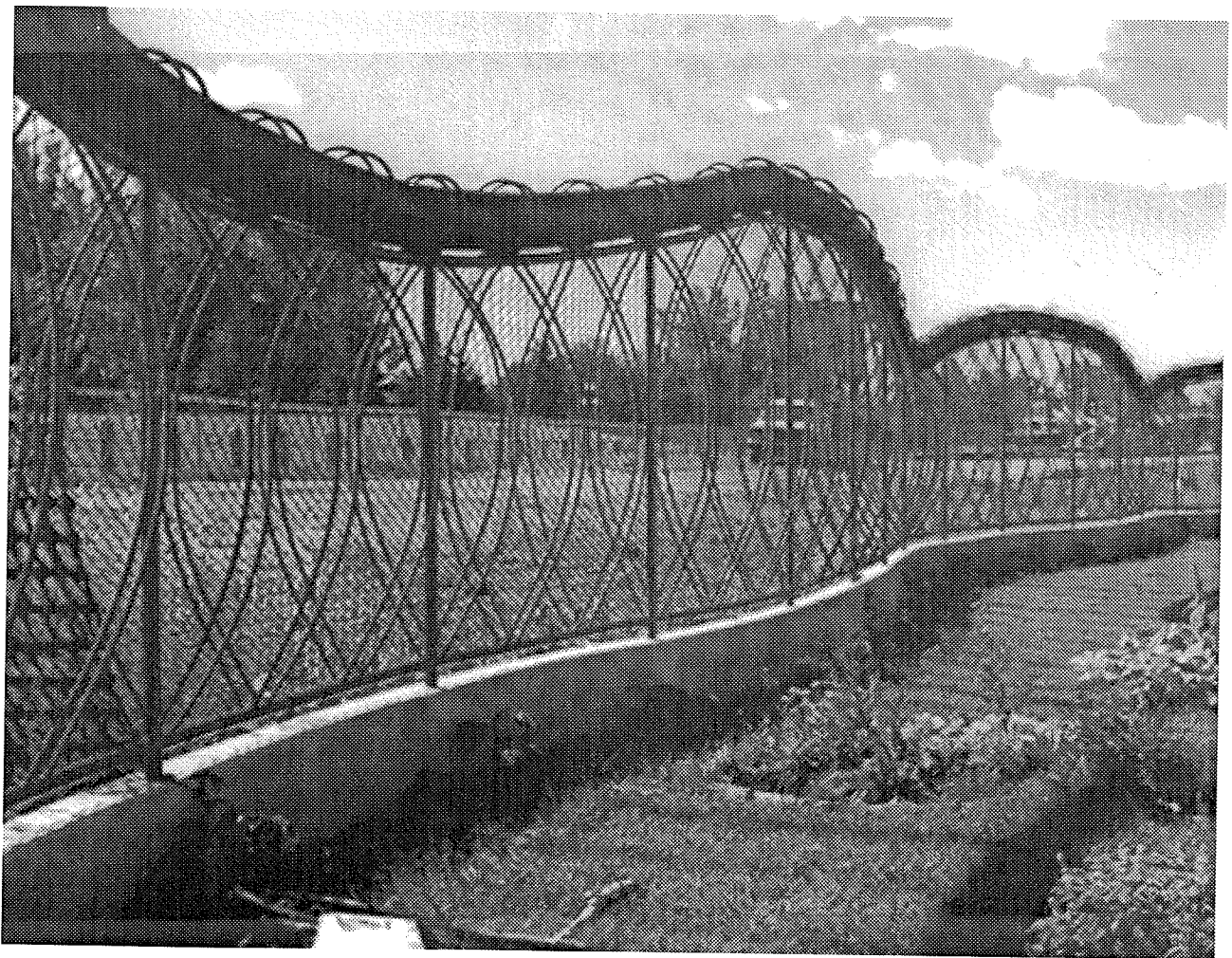


FIGURE 31: Serpentine Character Fence at the Manitoba Children's Museum



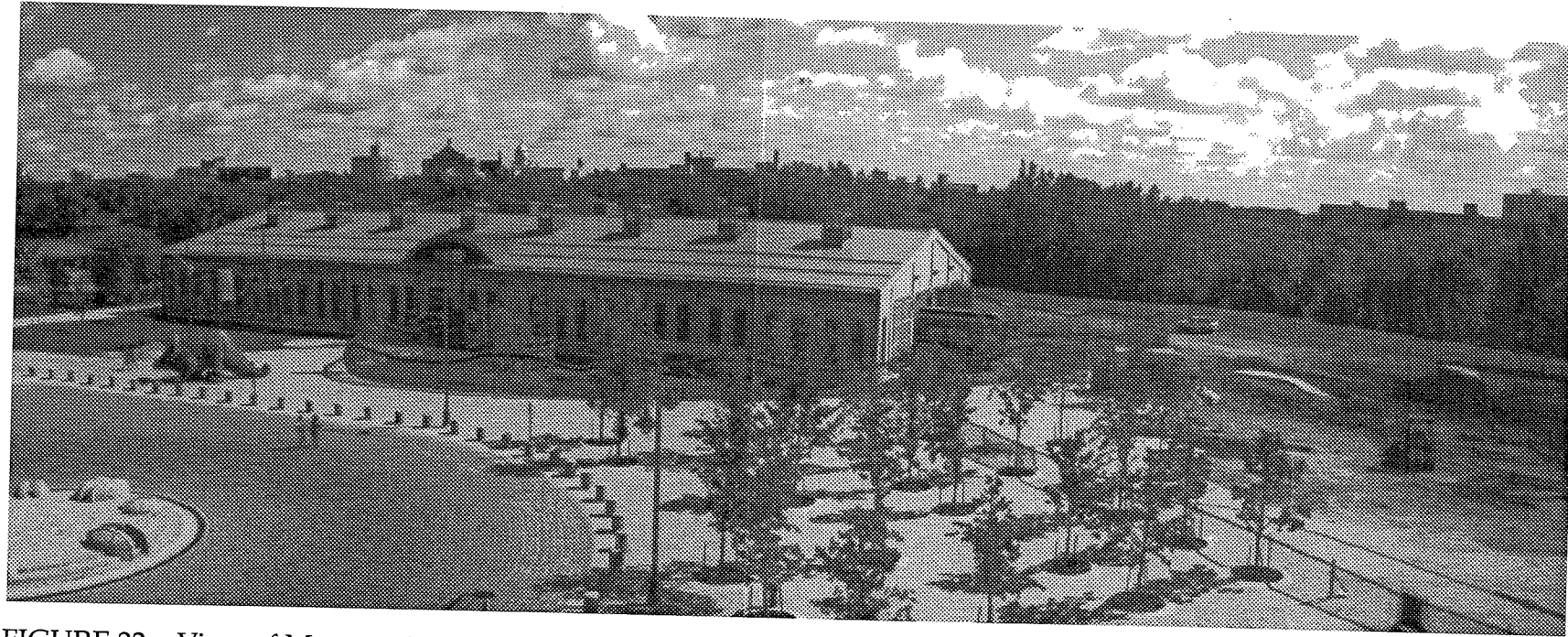


FIGURE 32: View of Museum Front from Second Floor of the Johnston Terminal

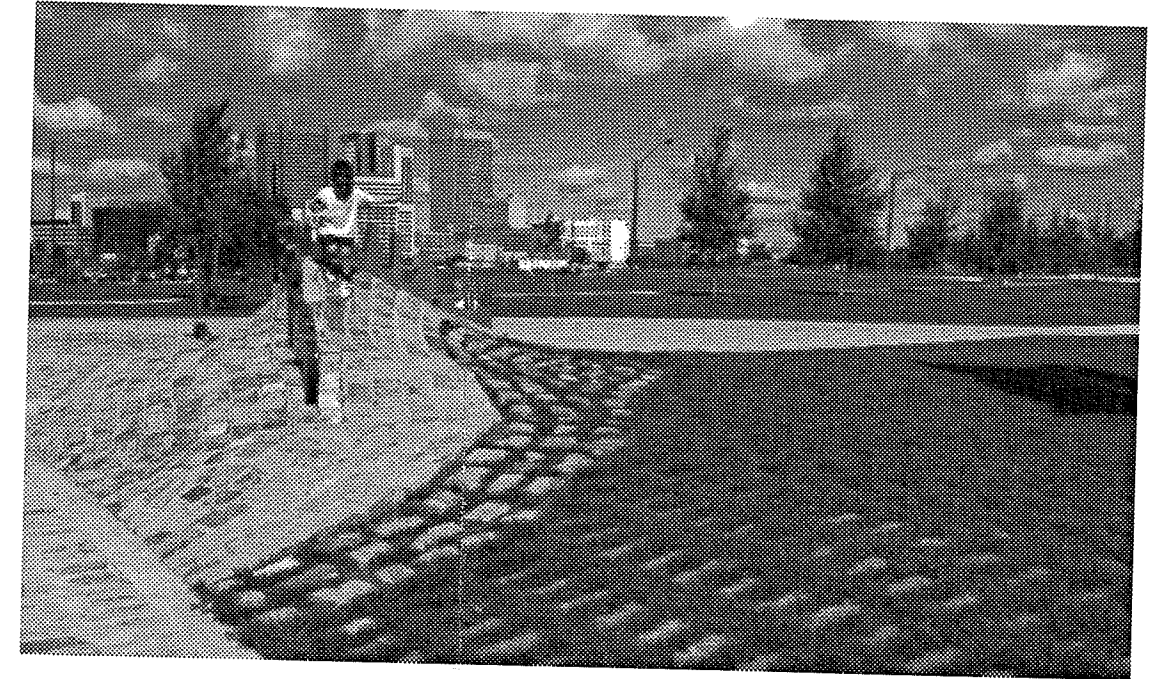


FIGURE 33: Museum's Sculptural Signage and view of City Sky Line to the West



FIGURE 34: View of Riverbank East of the Museum from inside the Proposed Exhibit Space





FIGURE 35: View of Museum from Plaza Area southwest of the Museum

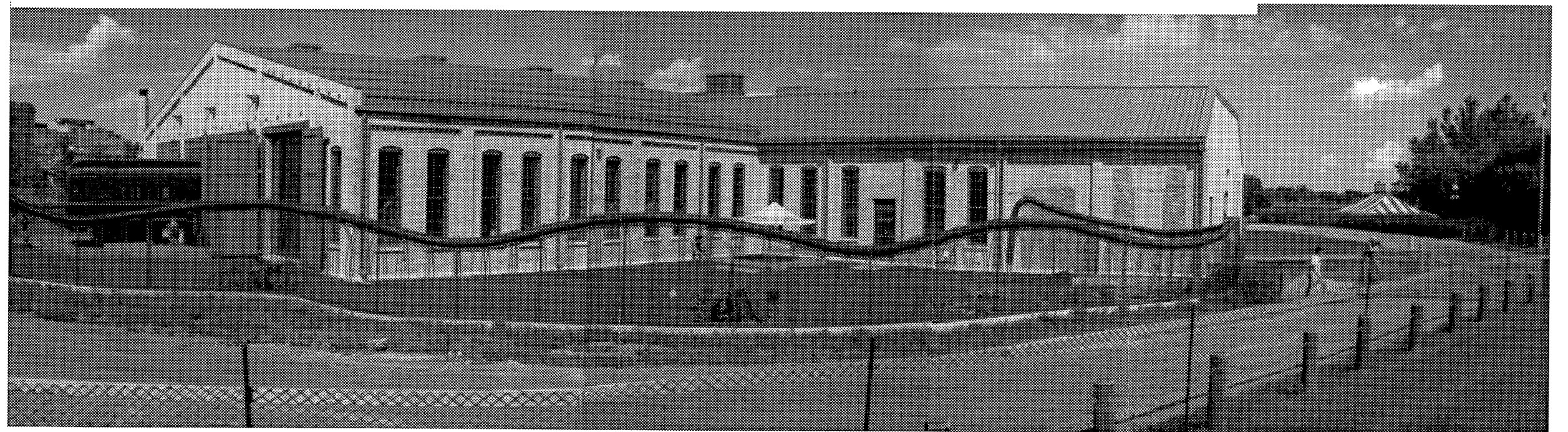


FIGURE 36: View Into Proposed Outdoor Exhibit Space - SE corner of Museum.

## Riverfront Focus

Only recently has the potential and beauty of the rivers been explored and developed for the benefit of the citizens of Winnipeg. Like many other North American cities, Winnipeg had for years turned its back on the beauty and the potential of the rivers. The Forks development priority has been the creation of public areas to reintroduce people to the rivers that are home to the historical beginnings of Winnipeg and Western Canada (Forks Renewal Corporation). A promenade or Riverwalk, 20 feet wide (6 m) winds along the rivers edge from Provencher Bridge to the Legislative Building, with planned extensions in both directions, providing pedestrian access at water level. Docking facilities exist at three points along the promenade, with a small marina developed by the Market Plaza. The two rivers offer abundant potential for water-related activities, and provide a scenic link by water to numerous points of interest within and outside of Winnipeg.

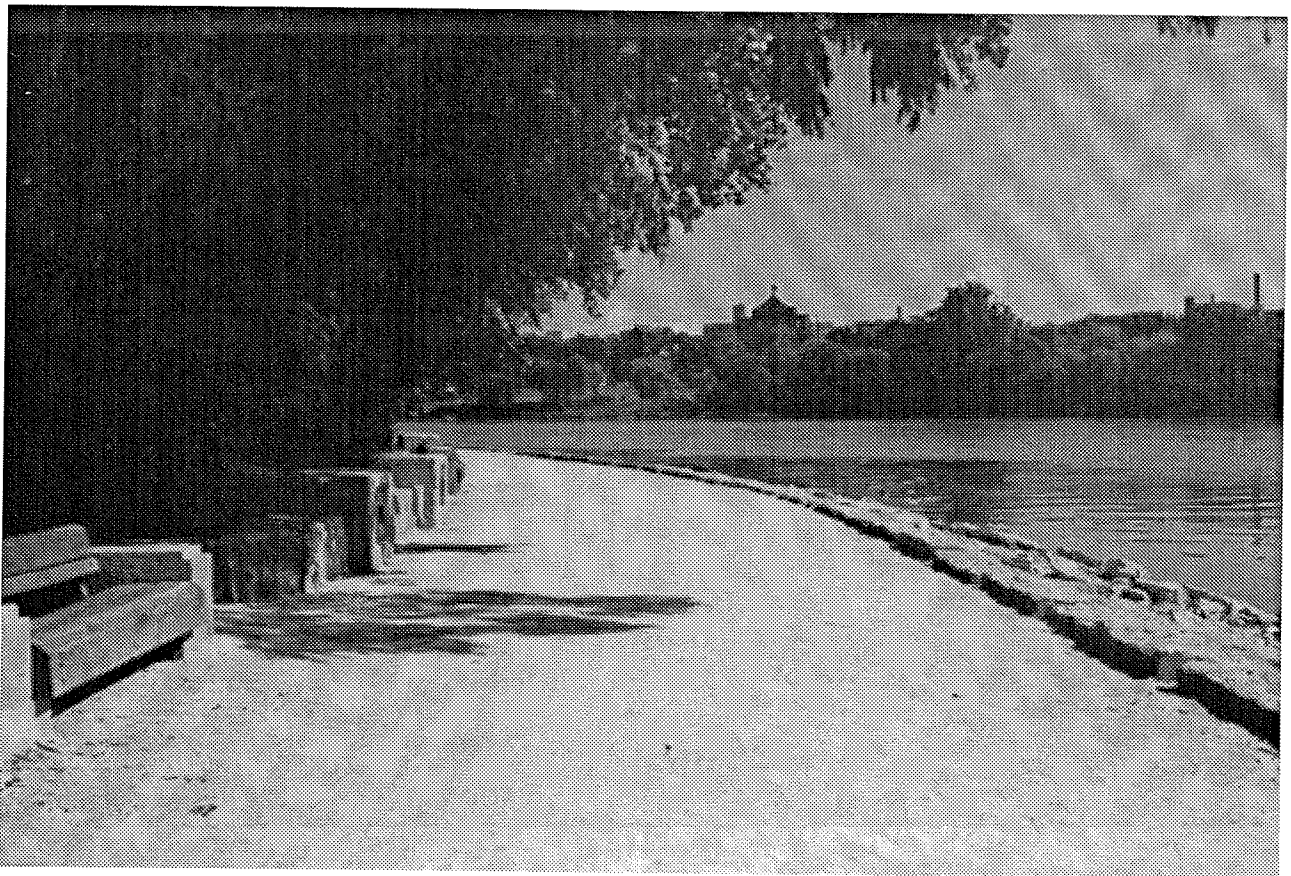


FIGURE 37: River Promenade; looking NE from the Assiniboine and Red River Junction





FIGURE 38: Informal Network of Paths in River Terrace Immediately Below the Children's Museum - View Looking South



FIGURE 39: Informal Paths in River Terrace - View Looking North

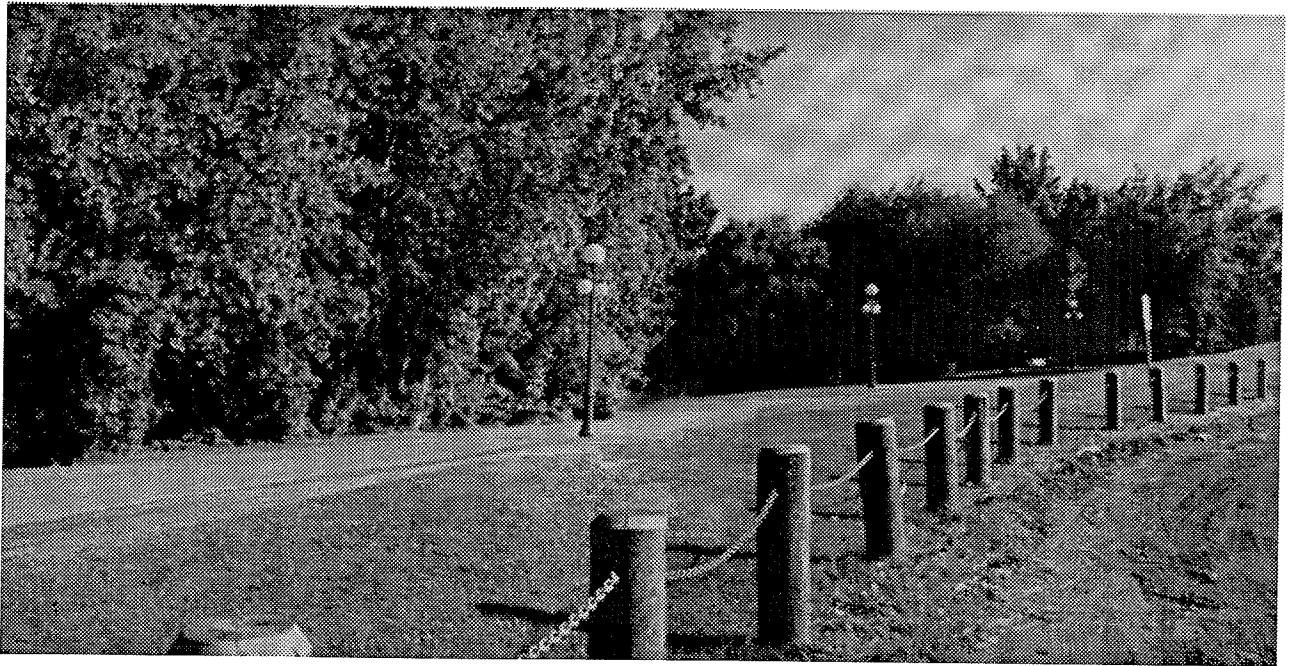


FIGURE 40: View of Pathway along Top of Riverbank adjacent to the Museum

### Vegetation

The study area lies within the aspen parkland biome which is a transition zone between the prairies to the south and the forests to the north. Of particular interest at the Forks site is the river bank community. Beyond the ribbon of river bottom forest, the vegetation is 'suburban sod'.

Riverbottom forests in this area have been extensively modified by human activity. In the past, flood plain forests have adapted to frequent inundation and ice scouring. Now, with flood control measures introduced with the Floodway and Assiniboine River Diversion, the nature of the community is slowly changing. Undergrowth that once found it difficult to gain a foothold now grows more easily and is changing the area's ecology. (Morgan, 1989)

The typical community makeup of the riverbottom or floodplain forest includes Manitoba maple, green and black ash, American elm, cottonwood, basswood, peach-leaf willow, and sandbar willow, with an undergrowth of ferns and nettles. The upper edges merge with bur oak and prairie communities. At the waterline typically, the vegetation merges with bank willow community dominated by various willows. In the case of the Forks, the

new promenade with rip rap beyond has changed the nature of the emergent vegetation. The Forks is a good example of the interface between man-made structures and the natural environment and the degree of sensitivity that is necessary to prevent destruction of the natural waterways.

The riverbank behind the path has been kept in its natural state as much as possible, "providing overhanging branches of willows, cottonwoods and maples".<sup>3</sup> The river bank with its dense growth near the top of the bank, acts almost as a barrier between the Forks park and the river. The ribbon of vegetation is broken by the two formal connection points down to the river at either end of the Historic Park Site, with a third connection point at the Market Plaza Area. However within the flood plain area beneath the canopy is a wonderful connection of informal pathways (monkey trails). The floodplain has minimal undergrowth as a result of the dense canopy and the sedimentation deposited in the flooding of past three years which virtually scoured the area clean.

**Environmental Factors** (Source "A Natural History of Riverbanks: Winnipeg Core Area", J.P. Morgan, 1989)

The micro climate of a site will impact how outdoor space may be used, and in the case of an environmental learning environment what weather or seasonal opportunities are available to supplement the educational experience.

Winnipeg is typically known for having only half the year of 'nice' outdoor weather. This will have a considerable impact on the design of the outdoor exhibit area. The summer season is short and hot but a mild spring or fall can significantly extend the opportunity for outdoor activities. And while summer breezes usually are welcome, the combined effects of cold temperatures and a strong north wind can make for an extremely unpleasant and sometimes dangerous outdoor experience.

Winnipeg has a continental temperate climate unique to areas inland and not affected by ocean or large water body weather conditions. Characterized by higher summer and lower winter temperatures than the world average for the same latitude, it experiences wide variations in seasonal and daily temperatures. In the summer, highs can be expected in the upper thirty to forty degree Celsius range and can go as low as minus forty degrees in the winter. The average frost free days are about 120 days, from about

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3 Val Werier, "Forks Park gives Winnipeg a new dimension", article taken from Vertical File Architecture library - no date cited.

May 23 until about September 21. Annual precipitation averages 535 mm, with about 410 mm falling as rain during spring and summer, supplemented by 125 mm of snow in the winter. Located 240 m above sea level and at 50.5 N latitude, the city receives 2177 sunlight hours per year. Despite the extremes of the seasons, sunlight is a constant and important feature of the Manitoba climate.

For a temperate climate each season has its distinct character and delights, making the seasonal transition a much enjoyed facet of life in Manitoba. Spring and summer showers add life, some variety and relief from the heat. Pleasant summer days become cool and colourful as fall approaches. Finally the white downy blanket of winter, combined with the crisp temperatures, creates a completely new atmosphere. Dramatic variations in the character of the natural light are another weather-related phenomenon that makes the prairie landscape unique.

The prairies often experience sudden violent changes in weather. Due to these extreme violent changes, which can occur in all seasons, great inconvenience and damage can result. These factors must be considered in the design of an outdoor environment for both the opportunities and constraints that they pose. Where possible some of the common phenomena should be accommodated, exploited, and celebrated.

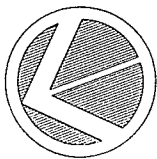
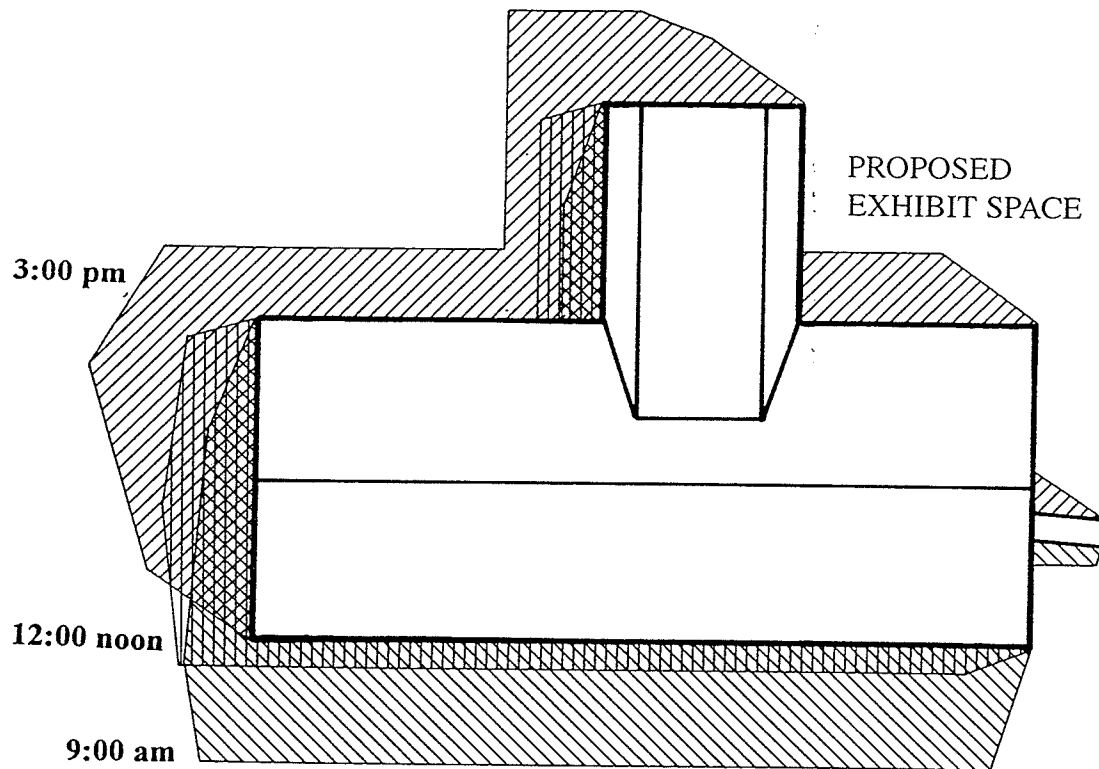
### Solar Analysis

Analysis of the sun paths indicates the degree of shade around the building at any time and day of the year. The south east side of the museum building, which is the area of exhibit focus, has little relief from the sun year round. The east and west sides experience partial shade for half the day. (See Figures 41-43)

Micro climate modification pertain to that of sun protection and plant growth. Exposure to the sun relates to sun angle has an impact on reflectivity of water surface and glare off snow and ice. The importance of the sun in the cyclical natural processes should be highlighted.

The outdoor development can take advantage of its ability to transform experiences with water (shimmers, glints, glares, heating/cooling effects). In the winter the low angle of the sun is likely to reflect and glare off the snow to the south,. adding some topography can minimize the lack of contrast.

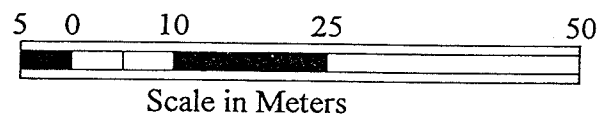


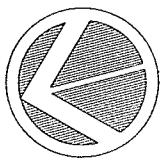
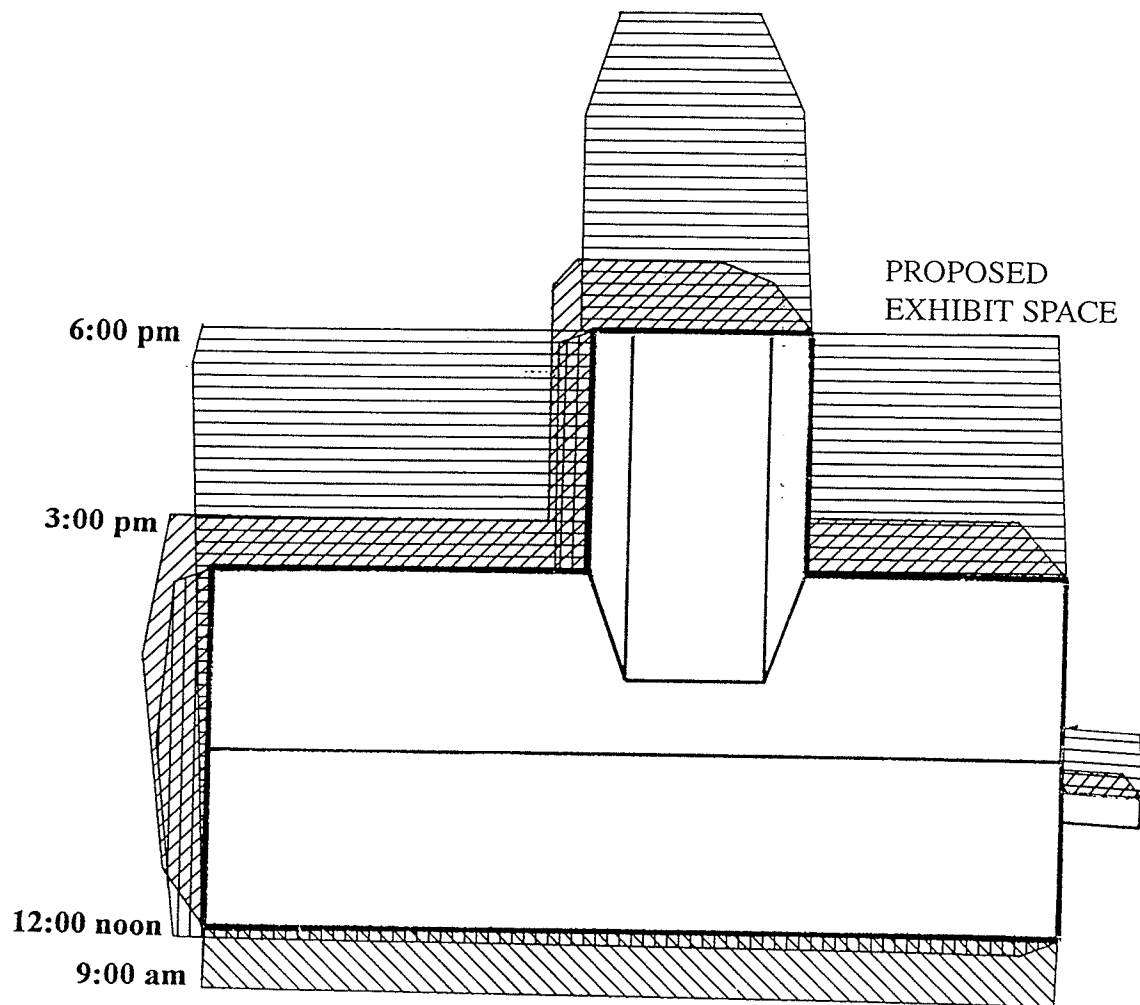


Shadows on March 21st and September 21st at  
9:00 am, 12:00 noon and 3:00 pm.

Areas of deepest shading indicate areas in  
shadow for greater portions of the day.

Figure 41  
SOLAR ANALYSIS - March 21st and  
September 21st

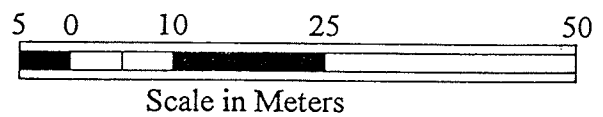




Shadows on June 21st at 9:00 am, 12:00 noon,  
3:00 pm and 6:00 pm.

Areas of deepest shading indicate areas in  
shadow for greater portions of the day.

Figure 42  
SOLAR ANALYSIS - June 21st



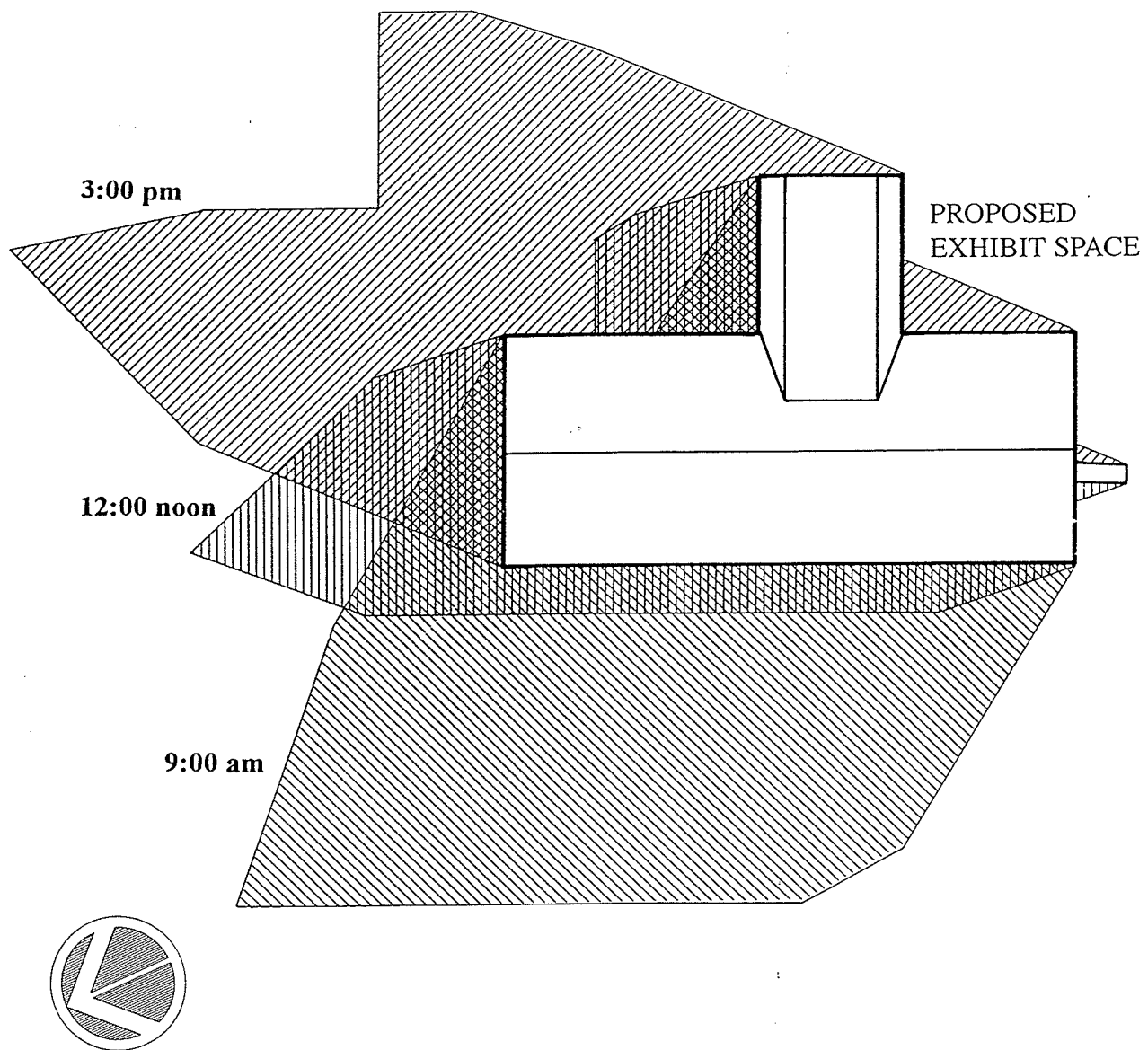
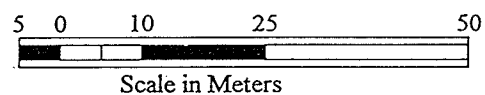


Figure 43  
SOLAR ANALYSIS - December 21st

Shadows on December 21st at 9:00 am, 12:00 noon and 3:00 pm.

Areas of deepest shading indicate areas in shadow for greater portions of the day.



## Wind Analysis

The severity and direction of the wind is important consideration when designing any outdoor space. This is especially important for small children, who can easily overheat when involved in playful activities. The movement of air reduces body heat, but also carries dust and airborne pollutants and in unfavorable conditions can cause discomfort. As an educational interpretive measure, the winds can be harnessed for energy, or used as a measure of speed and intensity could be the basis of a demonstration on evaporation.

The frequency of wind direction and speed are graphically depicted by a wind rose, which indicates the direction and speed from which the winds blow. The four wind roses shown in Appendix D depict: average yearly frequency of wind direction; average yearly frequency of wind speed; frequency of winter wind direction; and frequency of summer wind direction.

The average wind speed is over 18 kilometers per hour (kph), and gusts up to 50 kph occur several times per year. Winter winds predominate from the south (15%) and the north-west (9%), while summer winds predominate from the south-east (16%) and south (13%). Winds are calm less than 3% of the time for all seasons, so shelter must be considered for an outdoor site.

The Children's Museum site is sheltered on the east and south-east sides by riverbank trees, but is exposed on the south-west, west and north. Parking lots to the west and north-west may result in an increased level of airborne dust and blowing sand on the west side of the building, but mostly this will not impact the exhibit space. The large open fields to the north and north-west have few obstructions to dampen or redirect wind, and winds will appear strongest from these directions. Localized effects should not be significant since there are few buildings nearby.

## **Access & Circulation Patterns**

Parking is to the west of the building, as such most patrons arrive from the west, approaching the front of the building.

Secondary access exists on the riverside (east end of the annex) providing access to a portion of the museum that is presently rented. The large red doors on the south side of



the museum by the train and amphitheater are a visual draw from the south. The new fence is another visual draw, enticing you to find out where it comes from and where it goes, leading you around to the front entrance.

Area to north, south and east are pedestrian zones with vehicular access restricted to service and construction vehicles. This provides numerous vantage points into the proposed outdoor museum exhibit space. There exists only one entry point into the proposed exhibit space (see Figure 30 - Site Analysis).

## Chapter 6.0

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# PROPOSED EDUCATION PROGRAM

## *On Water Cycles for the Manitoba Children's Museum*

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*"Most elementary children have some understanding of the water cycle. They know that rain falls on the mountains and flows through rivers to the ocean, where it evaporates and is blown back to the rain cloud. Rather they know as much as that standard picture tells them. Few however are able to put themselves into the picture. They see tap water appear and disappear, but not in their minds as part of the same cycle." <sup>1</sup>.*

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<sup>1</sup> Martha Munroe, The "All New Water Revue", Science & Children, Jan 1990, pp. 33

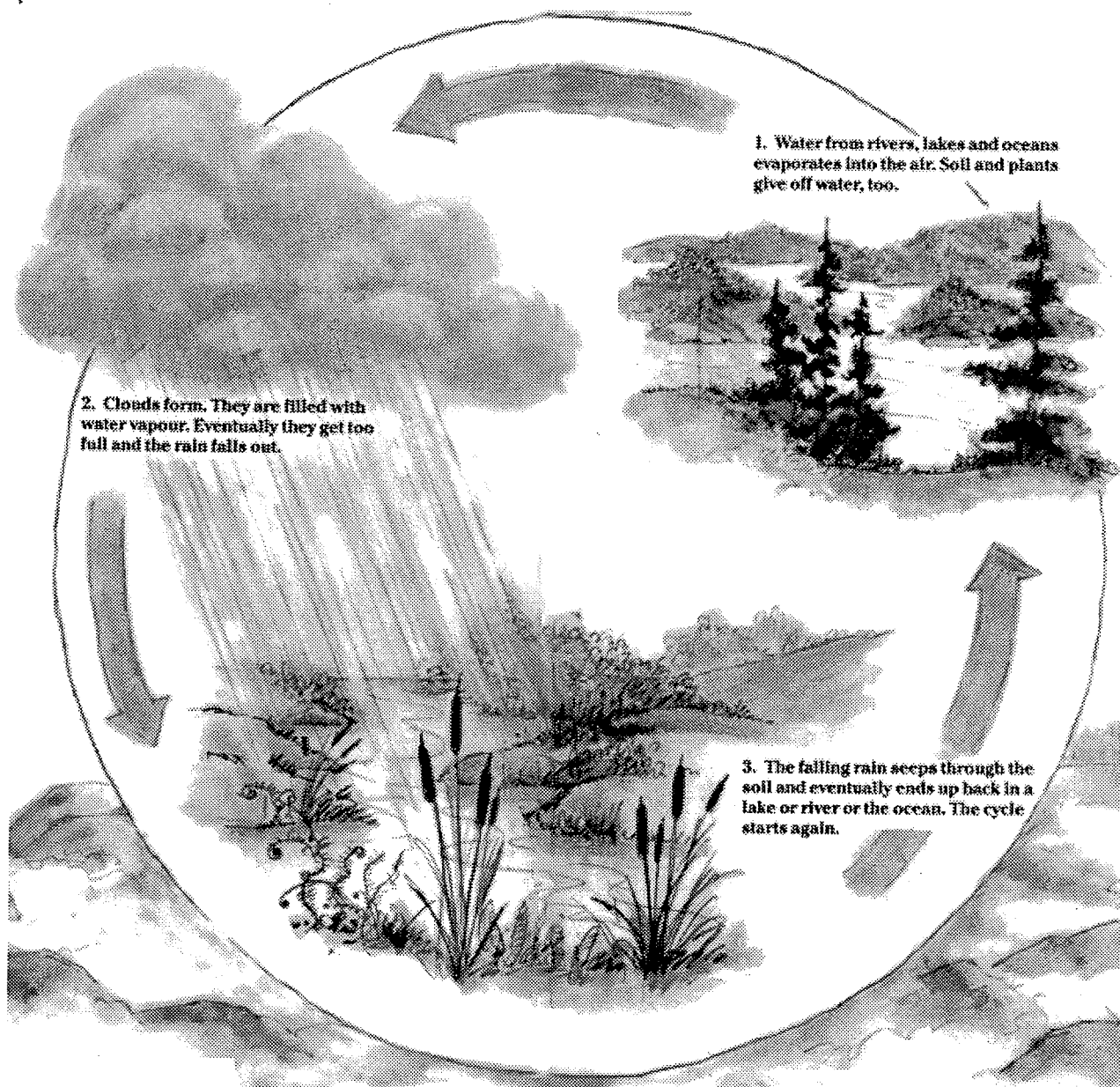


Figure 44: The Standard Image of the Water Cycle  
(Source: Savan, 1991, pp. 48-49.)

## **Education Program**

The illustration and quote from the preceding pages bring to light a serious problem with respect to how we learn about and perceive the environment: that being the fact that man is not represented in the process. This presents an unrealistic view of the world. We understand that natural processes cycle continuously and if left alone will maintain a balance, but this is before overuse and pollution are factored in. Before society can truly realize the impact they have on the environmental resources they need to understand where they fit into this natural cycle. Even in cities: it is not a separate process reserved solely for rural communities. It is one big system and everyone and everything is affected.

A program establishes the educational framework from which to structure the design of the exhibit. To determine the appropriate context and spatial details for learning it is necessary to know the 'curriculum' or theme and the intended message of the exhibit. In this case the specifics of the educational program became a critical determinant of the design program, since the design is directly related to the cycle that is being interpreted. This section explains the exhibit focus and educational intentions.

### **The Water Cycle: A Vehicle for Learning About Cycles and Systems**

The earth cycle is comprised of three smaller cycles: the hydrologic (water) cycle, the air cycle, and the mineral (food) cycle. Every minute of every day these invisible cycles are at work. They sustain the life on the planet. They are so interconnected that it is difficult to isolate just one, because as one cycle is upset or modified, the others are also affected.

The determination to use water as the primary vehicle for exploring cycles and systems was influenced by three factors:

- Contextual Rationale: Recognition of renewed interest in Winnipeg's waterways, which was initiated with the Forks development.
- Practical Rationale: Water has the combined benefit of being important for both practical and aesthetic reasons. Compared to the limiting qualities of the air cycle, water has the benefit of being tangible: you can see it, touch it, hear it and witness transformations in a short time frame, making it an ideal material for illustrating continuous movement, transformation and potential impact in all seasons. Compared with the mineral cycle, water illustrates the notion of change much quicker.

- Aesthetic Rationale: Water is an exciting vehicle through which to explore impacts on systems and cycles. It is a fascinating and mesmerizing element that provides a perfect springboard for emphasis on both facts and feelings.

The specific theme and lesson proposed was shaped by:

- Urban Focus: the fact that the Forks presents a predominantly urban image. People need to be reminded that urban settings are a part of the natural environment: "to suggest that children in urban environments are cut off from the natural world" is "a short sighted failure to acknowledge the reality of the environmental interactions."<sup>2</sup>
- Complement Other Programs: this urban character serves to differentiate it from other Winnipeg vicinity environmental education centers, which have a more rural character.<sup>3</sup> The potential to compliment, (and not duplicate) these existing programs by focusing on urban issues, was deemed important.
- Noble Professional Intentions: from a landscape architectural perspective, helping people to understand the importance of natural systems for maintaining a healthy environment is paramount. Helping them to understand the impact of their actions on the landscape, and hopefully accept some responsibility for their decisions, will only help to further our push for healthier environments.

The importance of this focus is further emphasized by Kates & Katz, who found that children hold varying degrees of misconceptions about water and the hydrologic cycle. (Kates & Katz, 1987.) Though never quite seen as a cycle, children's scope of the hydrologic connections increase with age. It is difficult for children to value natural systems until they know that the systems exist. Understanding the system means understanding the workings of the whole as well as the details of each part in the system.

## Children and Water

Water is a special part of the play world of a child. As a multi-purpose resource it's use centers primarily on domestic, engineering and recreational pursuits. According to Katz and Kates dramatic and imaginative play is found by recreating the world of kitchen and nature at a more manageable scale, in an attempt to better understand them. Filling vessels (for imaginary cooking), and pouring back and forth between various pots

<sup>2</sup> Freeman, Clare. "Creating Greener Environments", Children's Environments Vol. 12, No. 3, 1995, p. 382

<sup>3</sup> A summary of these facilities and programs is provided in Appendix B

satisfies children's curiosity about the properties of water that led them to experiment with it in the first place. Outdoor water play consists primarily of 'engineering' projects that recreate natural phenomena (volcanoes, rivers etc.) These projects most frequently involve a group effort with different sets of children dividing the work among themselves.

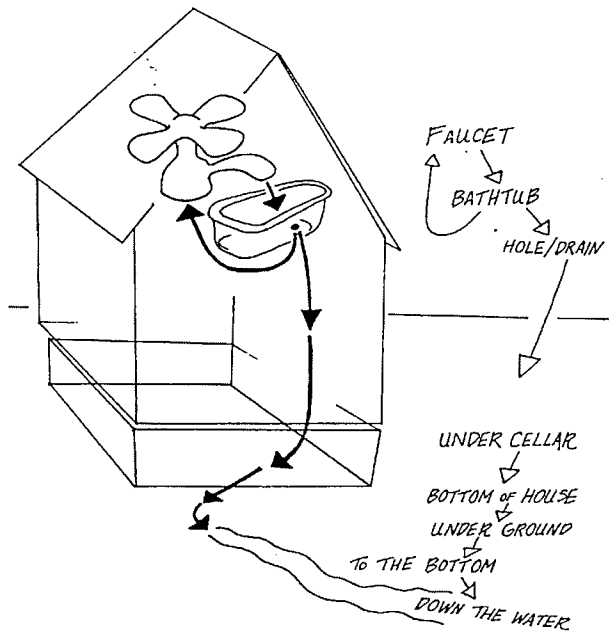


Figure 2. Three-year-olds' conception of the hydrologic cycle.

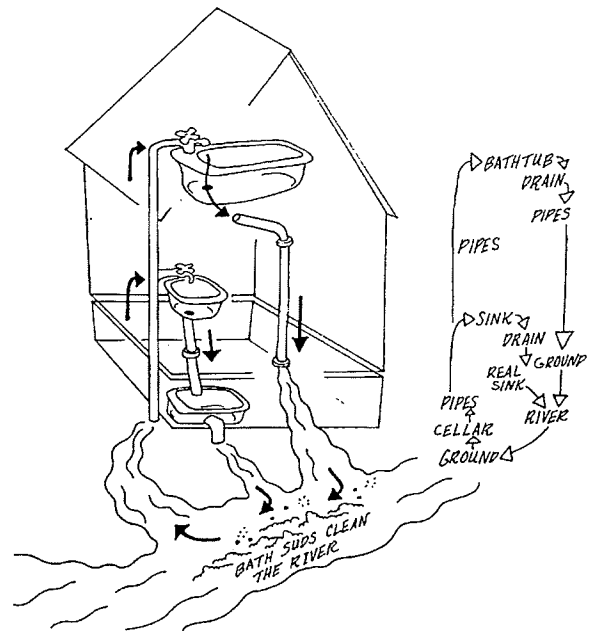


Figure 3. Four-year-olds' conception of the hydrologic cycle.

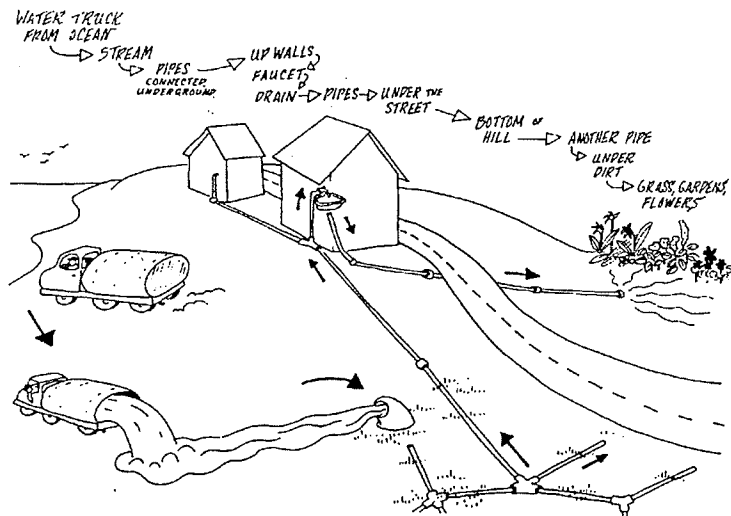


Figure 4. Five-year-olds' conception of the hydrologic cycle.

## FIGURE 45: Drawings - Children's Conception of the water Cycle.

(Source: Kates & Katz, 1987, p. 5 & 6)

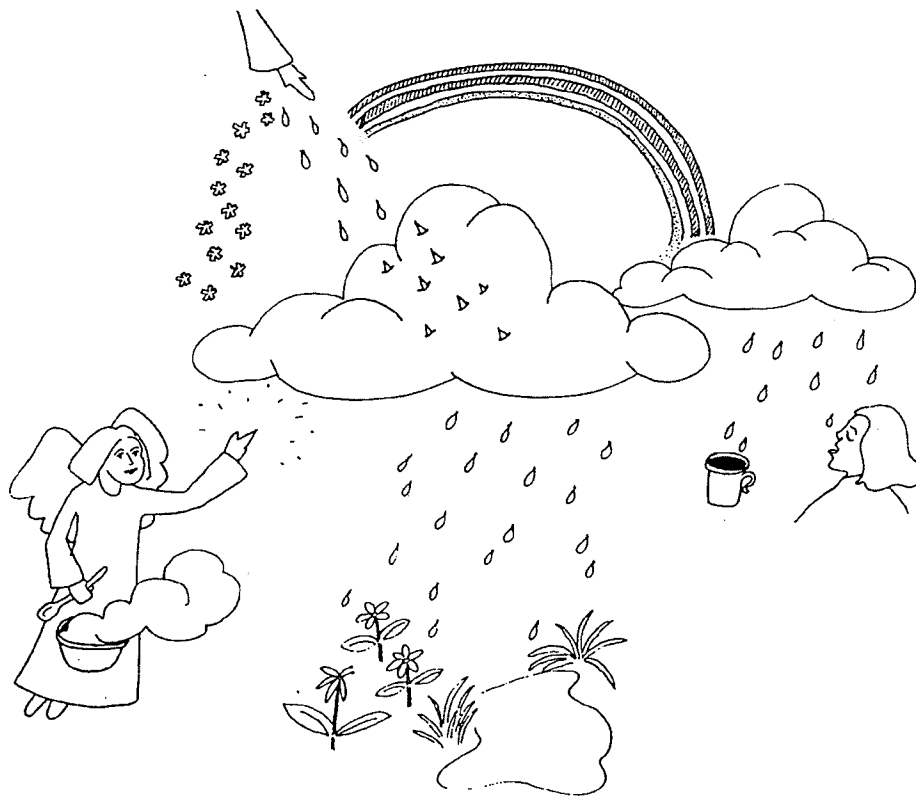


FIGURE 46: Snow and Rain made by God and angels  
(Source: Kates & Katz, 1987, p. 7)

The sensual and affective qualities of water are important especially to very young children. Watching water is a serious activity. Some children can sit entranced for relatively long periods staring out at the rain, or watching water flow out of the taps; they love to swirl the tub water with their hands making waves and eddies. Most of this kind of play is purely abstract - there is no end product or prescribed line of play to follow. Water is enjoyed for its unique qualities.

Children react spontaneously and curiously towards this element which cannot be compared with their relationship to other physical properties surrounding them. It's appeal is so great that interactions provide broad and exciting basis of experiences: it is wet, has sound, can be tasted, can be touched, is sprayable, warm or cold, mixed with mud, frozen, poured, moved felt. Additionally it has density and gives resistance, buoyancy and provides free movement, which adds to the appreciation and enjoyment of the substance.

## Educational Objectives

The exhibit intent is to create an opportunity for increased environmental literacy among children by providing hands on experiences that stimulate increased understanding of cycles and systems, and inspiring a new or renewed respect for the specialness of water.

### Key Concepts to be Imparted through the Program

- 1) An understanding (distinction between) Man made and Natural Water Cycles
  - In simple terms, the water cycle is the evaporation of liquid water into the atmosphere, its conversion back to either liquid or solid in the form of a cloud and its return in the form of precipitation. In the process the natural cycling of water achieves two basic functions: redistribution and purification. The primary difference between this and the man-made process of cycling water for man's consumption is that energy is required to keep the system operating. The second difference between the cycles is that the man-made process is not self-maintaining.
  - The man-made cycle operates within, and is dependent on the quality and quantity of naturally cycling.
- 2) Water is Important
  - to sustain life
  - has other important characteristics
  - we should appreciate its specialness; its emotional as well as its physical qualities
- 3) Nothing Ever Goes Away
  - the water cycle is endless and continual;
  - everything in nature is interconnected so an impact on one element affects others
  - the natural and man-made water cycles are also interconnected and therefore an impact on one affects the other: How do we maintain a balance ?
  - boundaries are irrelevant when it comes to environmental impact
- 4) For Every Action there is a Reaction
  - Understanding cause and effect: that what we do here may have its greatest impact elsewhere, and what is done 'there' may have its greatest impact here
  - we are all in this together and must act together to solve problems
- 5) Man has control over impacts
  - impacts can be negative and positive
  - both short and long term planning are required
  - understanding choices is the first step to decision making:



## Educational Theme and Lessons

The intent is to prepare a working 'model' of the manmade and natural water cycles, for placement within the site. Each process in the cycle (defined on pages 9 and 10), has the potential to be developed into a separate activity space, where more in-depth learning can occur.

There are three major program components which comprise the design:

- A) The natural water cycle,
- B) Inter-related stations which illustrate the processes within the natural water cycle, and
- C) Inter-related stations which illustrate the man-made water cycle

### A The Natural Water Cycle

An encapsulated view of the "whole" system in a simplified format is provided through a rain cloud which moves around and between a mountain and a large natural body of water. The cloud illustrates the processes of evaporation, conversion to liquid or solid and precipitation. This component is intended to provide a greater understanding of the 'stages' in the cycle, and the significance of those steps to sustaining the quality of the environment. As well, another intent is for the overall site to become a learning environment with specific activities or stations integrated throughout to help elaborate on more specific lessons.

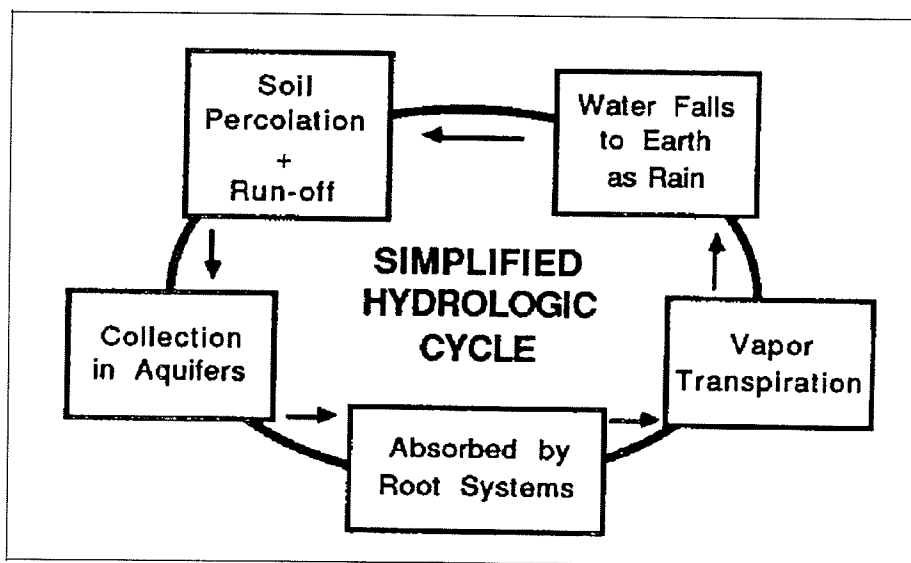


FIGURE 47: The Hydrologic Cycle with it's critical stages noted.(Source: Moore, R., 1987, 11)

## B) Natural Processes within the Water Cycle

A series of stations and exhibits will illustrate and promote the understanding of the natural processes outlined below and the importance of each for maintaining quality and quantity of water.

### 1) *Rainfall/Precipitation:*

Recognized as the source of water; with respect to where, when and the intensity; it represents the one process that man cannot manipulate or control.

The water that hits the ground then moves in one of two ways:

### 2 a) *Surface runoff :*

The effects of slope and surface material determines how and where water flows and what happens (sedimentation). In a natural state vegetation impedes the flow and minimizes erosive effects, in contrast to with water flowing over hard surfaces.

### 2 b) *Infiltration (percolation):*

The type of surface material determines the degree of percolation of water into the soil. Promoting percolation is an important part of the water cycle, as it provides nutrients to the surrounding vegetation, and acts as a cleansing mechanism for water, a natural filtration process.

### 3) *Erosion:*

A condition of run off and exposed soil. Lessons can help reinforce the importance of vegetative cover for stabilization.

### 4) *Ground water /sub-surface water:*

Water percolates into the ground to recharge ground water. Supports the idea of allowing as much infiltration as possible. It is important to note that anything on the surface can be carried into the ground water - which is also the source of well water.

### 5) *Storage:*

Rivers, lakes and oceans are the natural storage of the collected water from both surface and subsurface run off.

### 6) *Evaporation:*

That "mysterious" piece in the water cycle where water is transformed into clouds.

### 7) *Energy*

The combined effects of moving water and gravity can produce direct energy.

### C) Man-made Processes within the Water Cycle

Stations and exhibits within this component will illustrate man's use of water in an urban environment, incorporating hard surfacing, catch basins, pipes, pumps and levers, taps, sewers and filters to depict in an interactive manner the flow of water in a city, the impacts that we have through adding elements to the water, and how this connects to and affects the "natural" environment and water cycle. The following elements of the man-made process will be illustrated:

#### *8) Urban "use" of water*

- a) source - the source of local drinking water often comes from elsewhere.
- b) storage - we keep a reserve in reservoirs in the city, but often in water towers in rural areas.
- c) energy required to move it around
- d) use - domestic (this will be the exhibit focus)
  - others include: agricultural; industrial and recreational
- e) disposal - infrastructure and energy requirements
- f) treatment - before returning it to the natural environment waste water is processed to take out the impurities; another energy requirement.
- g) return to natural cycle

#### *9) Urban 'management' of water*

- a) land drainage systems - limits infiltration and recharging of ground water
- b) hard surfacing
  - speeds flow of water - erosion
  - less opportunity for percolation
- c) dams and devices to modify flow

## *Chapter 7.0*

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# *DESIGN RESPONSE*

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The following describes the decisions governing the conceptual design of the exhibit environment and a description of the elements and possible details that enhance the design.

The entire exhibit space is a representative working model of the water cycle and attempts to illustrate the processes and how and where man impacts the cycle. Two distinct characters serve to delineate the differences between the man-made processes and the nature. With the combined areas there are 7 main exhibit spaces. The man-made is comprised of four: the house, under our city, water service and water disposal. Within the natural there are 3 specific exhibit areas, however the framework of the whole site offers additional interpretive opportunities that have not been considered an exhibit.

This is being achieved by the combined aspects of the layout of activities, arranged to correspond to stages in the cycle as illustrated schematically in Figure 48, and by the activities themselves. As a result, the two tended to evolve simultaneously.

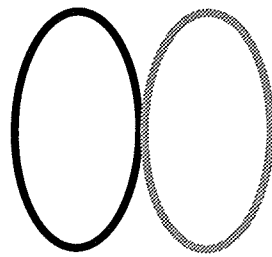
The key aspect of the design is that water becomes the common thread flowing between and linking the various areas. As such, the proximity of activities and the opportunity to connect them in some logical sequence that is illustrative of the cycling of water, was a primary design determinant. The source of water for each activity is somehow tied back to the natural cycle, and flows from one station or activity to the next and finally flowing back to the natural system.

### **Schematic Layout & Zoning**

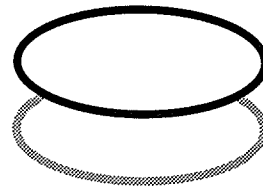
- Two Thematic Zones
  - the "man-made" (urbanized) environment and,
  - the "natural" (non-urbanized) environment, fairly distinct but overlapping.

Earlier determinations that the experience be positive and non-prescriptive (non-judgmental) made it necessary to determine how the relationship between the man-made and natural cycles would be portrayed. The important message to come out of this was that the man-made water processes, though distinct and seemingly separate, exist within the natural; that the natural cycle was the basis from which and into which everything else feeds.

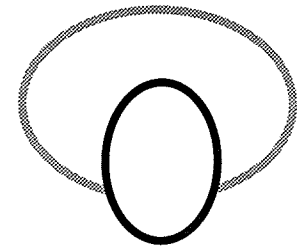
Similar to schematic 'C' below, this exhibit has the man-made environment nestled into the center of the exhibit, with more natural environment encircling it.



A: Seperate and  
Distinct systems  
Operating side by side -  
Single point of contact



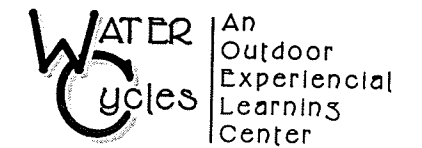
B: Man made  
superiposed on  
the natural -  
quite seperate



C: Man made enveloped  
and operating within  
the natural -- many  
points of contact

Figure 49: Schematic Representation of the Man-made/Natural Water Cycle


- Entrance location / indoor - outdoor transition  
Locate as close as possible to the existing washroom facilities (moving water may necessitate quick access!). This prevents disruption to existing exhibit spaces and ties in directly to an exiting corridor. The proposed future green house offers a future additional entry point. Locate a large orientation space adjacent to the entry to accommodate school groups or special programs.
- Activity levels/zones:
  - passive zones : mostly located near the entrance on the main level so as to provide a 'wind down' area before leaving the exhibit. A 'water wall' (clear Plexiglas framework filled with water) separates a quiet play area from the orientation space. The wall acts as a prism in the morning sun, creating interesting patterns and reflections on the surfaces beyond. Quiet retreat areas located in two other locations throughout the exhibit space.
  - active zones: the remainder of the site calls for varying degrees of interaction.
- Zones of wet & dry,
  - more visual and auditory experiences are located near the building entrances, associated with passive activity spaces, while opportunities to get wet are located away from the entrance.
- Focal Points
  - interesting or prominent (i.e. vertical) elements were located at strategic points to catch peoples eye and where possible provide views out to surrounding site



e Input of External Energy  
Required to Move Water

 Manned Control

Activity/Exhibit Spaces -  
Relating to Man-Made


 Activity/Exhibit Related to Natural Cycles

→ Pedestrian Movement

Man-Made Piped Water

○○○○○ Land Drainage

## Flow of Water



Natural Cycle

Lessons

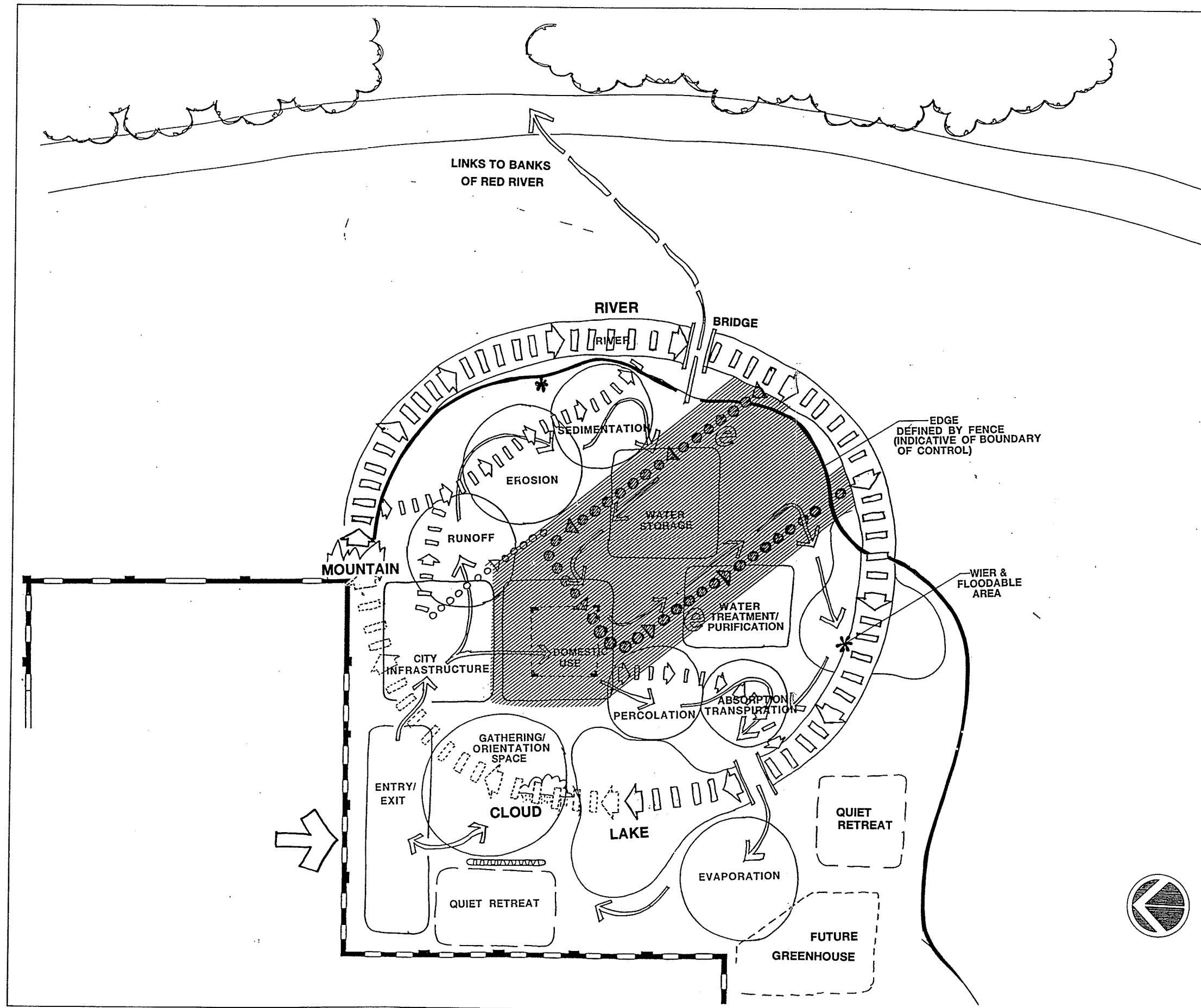
FIGURE 50:  
ACTIVITY RELATIONSHIP  
DIAGRAM

5 0 5 10

SCALE IN METERS

DESIGN RESPONSE

7-4



## Site Layout Determinants

- The Circle - symbolic reference to cycles

The strongest determinant of layout is the representation of the natural cycle: depicted by the flow of water from mountain via river to lake/ocean and back to the mountain via cloud. It is laid out on site in a fairly distinct circle, a strong graphic symbol of cyclical processes. The exhibits are located within the circle, drawing water from the natural cycle, either by pumping water from the river, or collecting water as runoff from the mountain, and returning it to the river after 'use'.

- The Fence:

The relocated serpentine fence undulates and crosses the 'river' such that most of the river is outside of the fence line. The undulation serves to soften and add interest to the exhibit space edge. Placing the 'river' outside of the fence for part of its length, allows for interpretive opportunities about control and impact beyond our immediate environment.

- Entry / Exit

Though there is no beginning or end in the water cycle, it was decided that the entry should relate to the perceived 'source' of water - rain. Locating the access near the cloud helps to dramatize the transition. Entry & exit are in the same vicinity, reinforcing the idea of completing a cycle. A glass enclosure defines the transition area to the outdoor exhibit and is where stairs and a lift enticed people to begin their exploration on the second level, at the 'House'. It is also a storage place for role playing costumes that relate to water use: plumber, firemen, fisherman, scuba diver, fish, standard rain gear and splash suits and may also include or towels, rain gear.

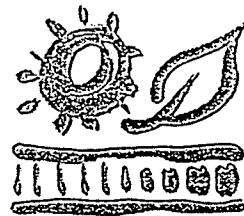
- Connection To River

The Museum should not claim ownership of any part of the riverbank, but instead should take advantage of the exhibit's proximity and focus on water to draw peoples attention to the river. A pathway leading from the exhibit space towards an overlook structure within the riverbank tree canopy, serves to draw attention and interest to the river. A similar vocabulary in the overlook's construction to that of the water tower creates a perceived link to the museum, and hopefully stimulates the same kind of interest to explore the riverbank environment. A gate permits direct access from the outdoor museum space to the river for special programs.

- Activities

The specific activities and how they interrelate was critical. See Figure 50 Relationship/Activity Layout as well as Figures 52, 53, 58 and 59 which describe each station/ activity in detail.

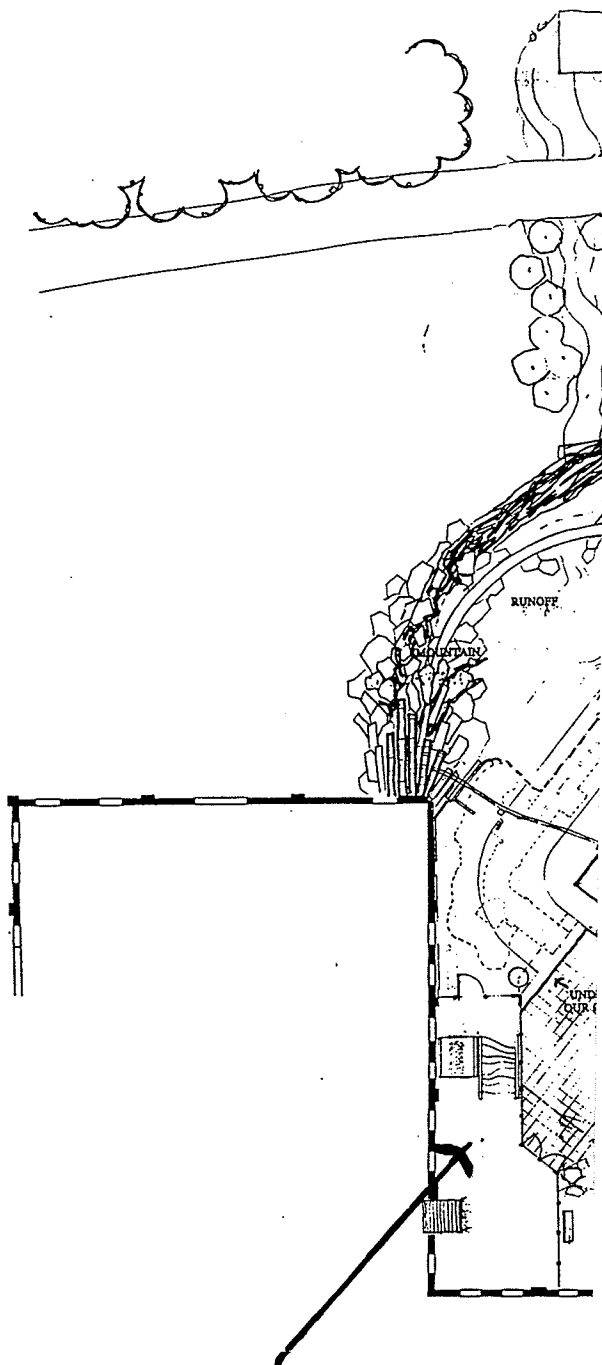




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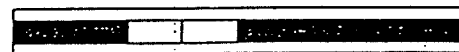
#### ENTRY/EXIT

Though there is no beginning or end in the water cycle, we decided that the entry should relate to the water - rain. Locating the access near the building entrance dramatizes the transition. Entry & exit are in reinforcing the idea of completing a cycle. The building defines the transition area to the outdoor exhibit space and a lift entices people to begin their second level, at the 'House'. It is also a place for costumes that relate to water use: plumber, fish, scuba diver, standard rain gear and splash.

FIGURE 51:  
PROPOSED DESIGN



10 5 0 10

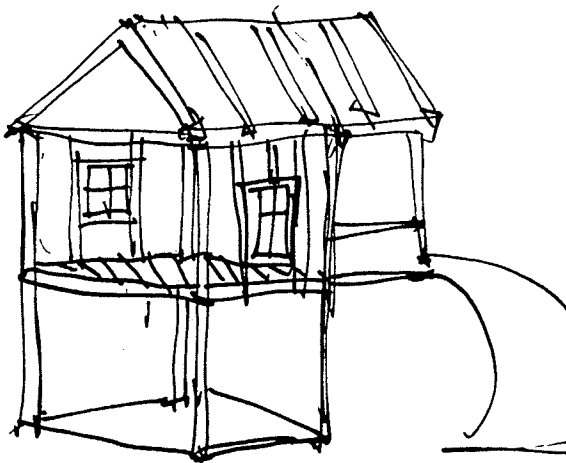


SCALE IN METERS

## FRAMEWORK OF THE MAN-MADE CYCLE (S)

### **WATER TOWER: An Icon Of Water Storage**

- Representative of our need to maintain a supply of water & need for energy to draw water from somewhere else for climbable structure with display panels to tell the story of h to Winnipeg.
- Represents where water comes from and, because water beyond the fence, indicates that water used isn't always a loc
- tower gives an overview of the entire exhibit, and theref system. Ambiguity of construction makes it suitable for imag
- Energy comes from individuals peddling bikes to run a wat the child relates the need for power, to their own physical ex
- Although water towers are not used in Winnipeg, they are communities, indicating that man-made influences are not lin

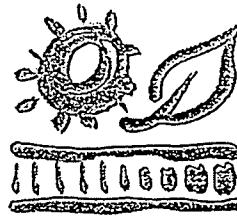


### **HOUSE: An Icon Of Domestic Use**

- Familiarity: personalizes the notion of daily water use & making it relevant to all. Helps individuals see their place in th
- Two levels: Shows how water gets to the house (by pip tower) and where it goes after use (to treatment center).
- Includes objects representative of home water use: a tap, toil machine. Each has movable parts and a drain of some sort containers with brightly colored foam or fabric pieces, repres put into the water, like laundry detergent or toilet paper. Chilc these down the drains and then watch them flow the throug that run between floors and follow a particle as it goes 'awa drain, into the sewer line and then to the 'treatment plant.) sizes work with the differing filters in the water treatment area

### **Under The City:**

- Reveals the unknown: the complex i needed to provide and dispose of water.
- Real: allows interaction with parts of th unavailable to children: a manhole provid the upper level, sewer pipes can be crawle hydrant and light standards give realistic str
- Double walled sewer pipes with grating : allow children to hear the echo sound that make makes in a pipe (without getting v basin adds light and acts as the source of in from overhead. (See Sketch)
- Caves in behind the pipes create n crannies to explore.



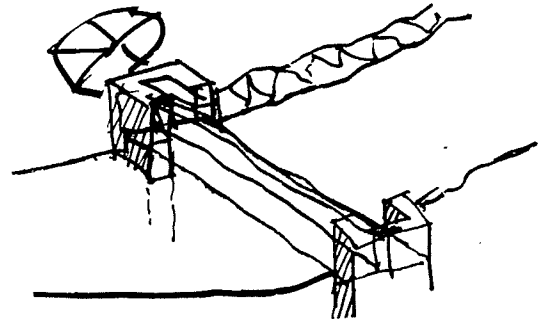
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### **ON**

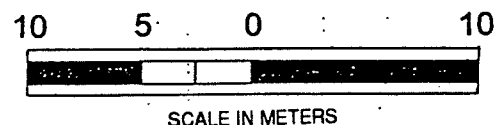
is an enclosed water table where levers and cranks  
filters to filter 'particles' out of the water. This is  
at the water coming into a treatment plant is not  
act. The second station is a little more hands-on,  
ter coming out of the treatment plant is safe for  
(there was concern that having only or the other  
impression.) Different size vessels and scoops  
r play, od pouring back and forth

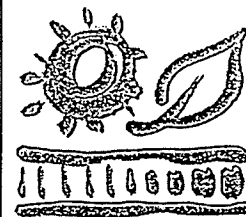


### **Weir:**

- Represents man's control and manipulation of natural system. A crank raises and lowers the height of the weir thereby varying the flow of water.
- It is possible to flood the area immediately behind it. Makes the learning environment infinitely variable, but also, illustrates man's ability modify the natural processes, often in areas that are far removed from the source.
- A working dam: but maintains trickle of water to the lake.

FIGURE 52:  
**MAN - MADE CYCLE  
PROCESSES/ ACTIVITIES**





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## EXHIBITS EXPLAINING NATURAL PROCESSES

### Runoff / Erosion / Sedimentation

- a series of interrelated exhibits that deal with water and movement over land. The water source for the exhibits is mainly from the 'mountains' and excess water in the hard surface area. For the spray nozzles, supplemental pressurized city water would be required.
- An interactive area which allows individuals to experiment with variables of slope, surface material and water pressure to better understand the effect that various conditions have on runoff.
- Closely related to this is erosion. A tiltable table filled with crushed walnut shells allows people to witness the erosive power of water, as a condition of slope and intensity. Different webbed gloves and damming devices entice individuals to find out about soil stabilization methods.

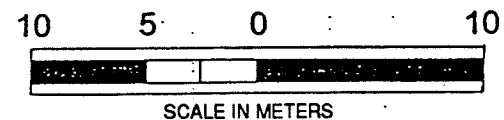
### Percolation / Groundwater / Transpiration

- Intended to provide an understanding of the importance of leaving natural patches of land in order to recharge the ground water. A two level exhibit, with the a portion above providing explanations of the percolation process and a portion below, a slice through, that illustrates how water filters and collects underground and Where well water comes from. A living tree and its roots below ground is the basis for discussing plant use and transpiration.

### Evaporation:

- Probably the most complex, mysterious and least understood aspect of the water cycle, because the process and movement is intangible. To reflect the specialness, this exhibit is located right beside the lake, but is somewhat secluded. Misters spray water along the inside edge of a mylar wall. This adds mystery and symbolizes the vapour/evaporation process.

FIGURE 53:  
NATURAL CYCLE  
PROCESSES/ ACTIVITIES



## FRAMEWORK OF THE NATURAL WATER CYCLE

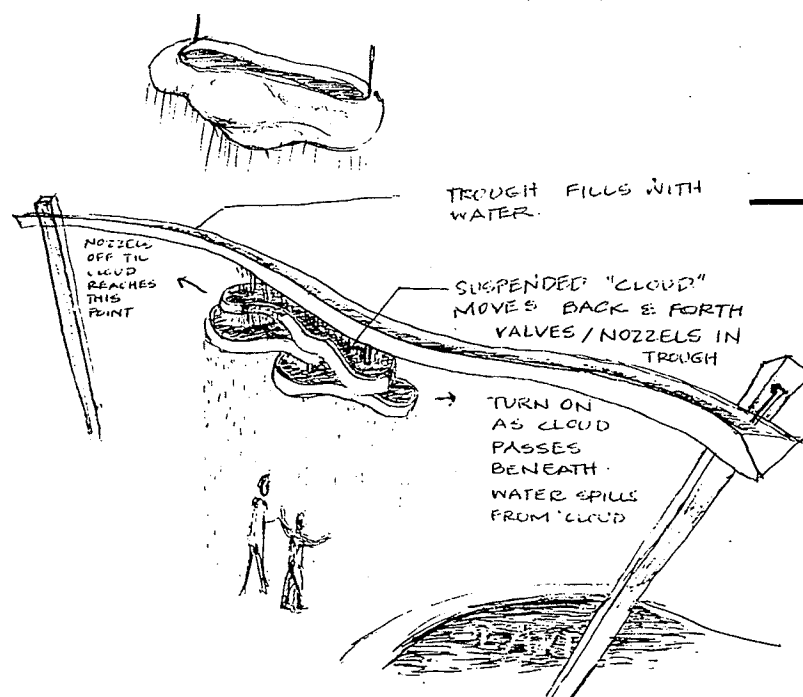
### MOUNTAIN:

- An abstract representation of a mountain, in reference to the standard depiction of the water cycle, most of which is not accessible from the exhibit space. Establishes a high point, and serves as the source of water for the runoff, erosion and sedimentation exhibits.
- Sited to the north so as not to cast shadows, and situated behind the residential area facades to make it seem distant.



### CLOUD:

- Abstract notion of a cloud. Moves back and forth between the lake and the mountain to complete the cycle (and figuratively the circle imposed on the site). Can act as a sculptural representation of clouds, but the intent is to have water falling on a random cycle. 'Rain' hitting the hard surface area (city street) and roof of the house, becomes the source of water for the infrastructure exhibit and the percolation/transpiration exhibits.
- Random timing of rain is indicative of the lack of control man has over the phenomena of precipitation. Supplement with flashes of light or rumbles of thunder to add intrigue and excitement. Rainfall is confined to the lake and the upper area: the orientation area stays as dry as possible.

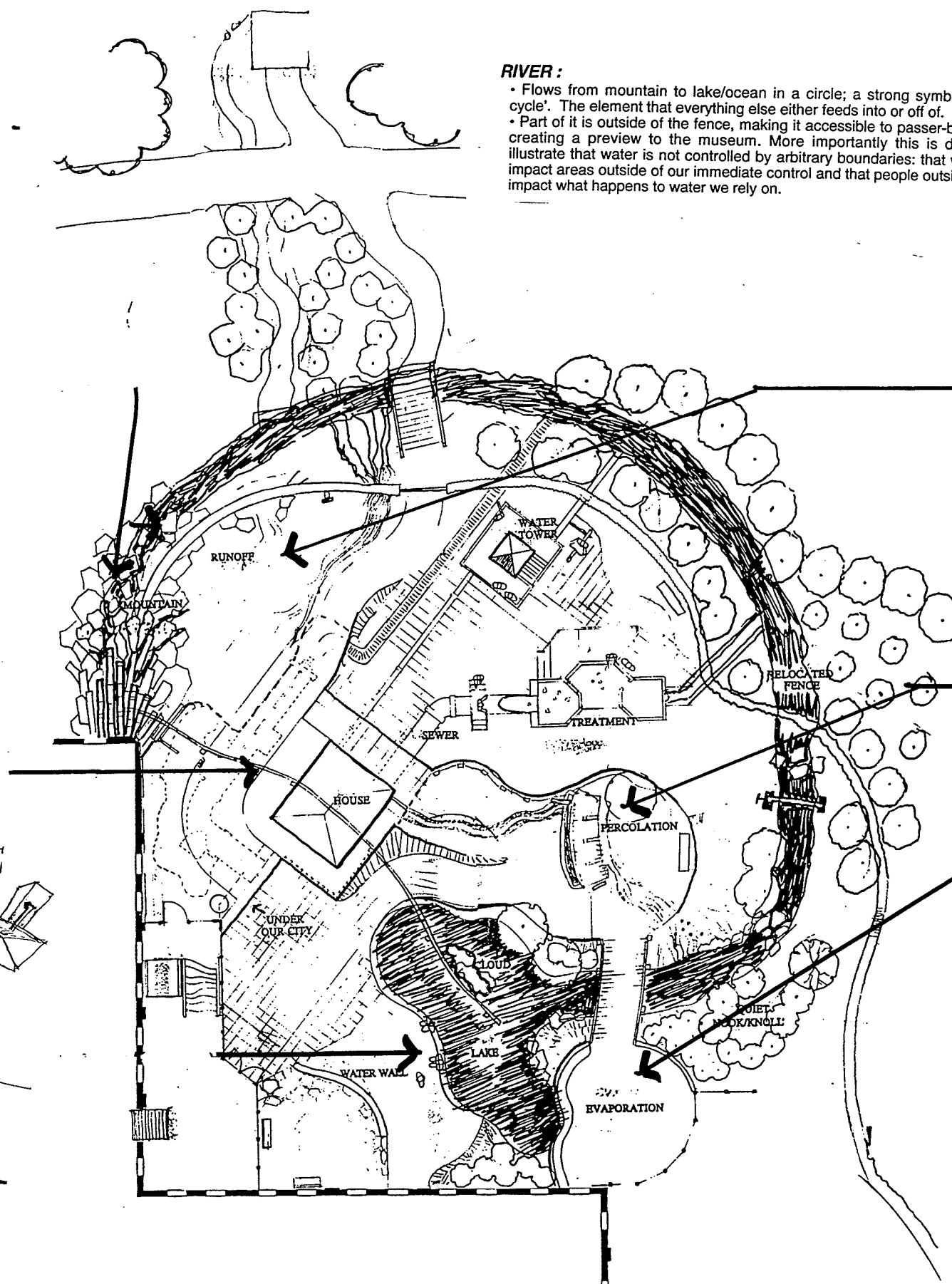


### LAKE / OCEAN:

- Represents natural collection and storage of water: where water flows to.
- Is a dominant visual feature from inside the museum and as you enter the exhibit area. Provides a sitting ledge for the orientation area.
- In sunlight offers reflective potential.

### RIVER:

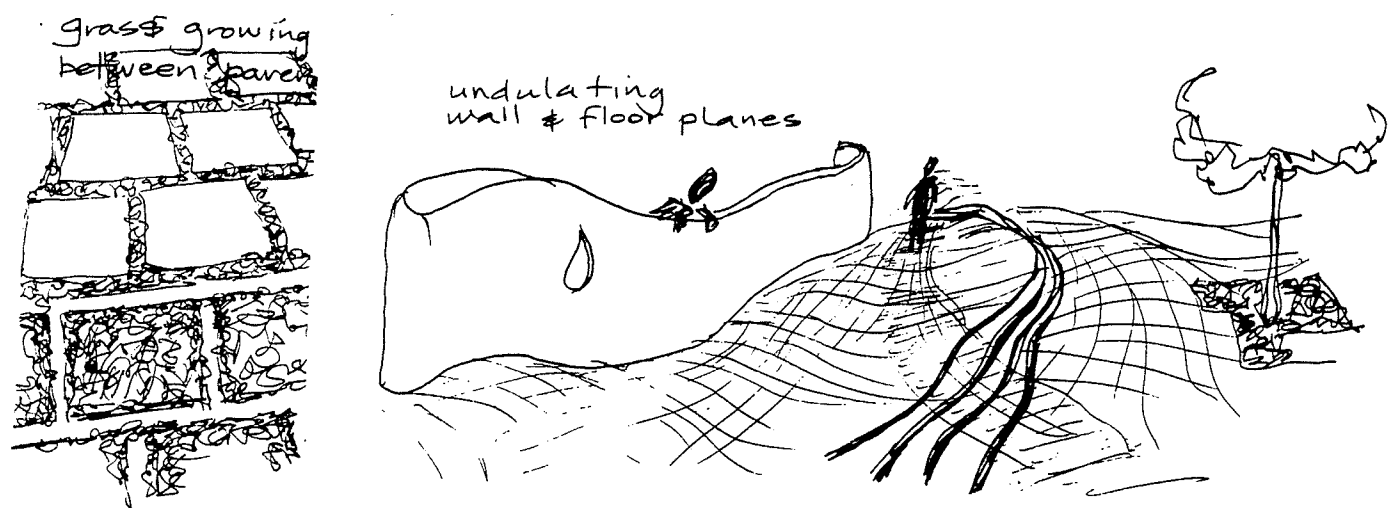
- Flows from mountain to lake/ocean in a circle; a strong symbol of 'a cycle'. The element that everything else either feeds into or off of.
- Part of it is outside of the fence, making it accessible to passer-bys and creating a preview to the museum. More importantly this is done to illustrate that water is not controlled by arbitrary boundaries: that we can impact areas outside of our immediate control and that people outside can impact what happens to water we rely on.



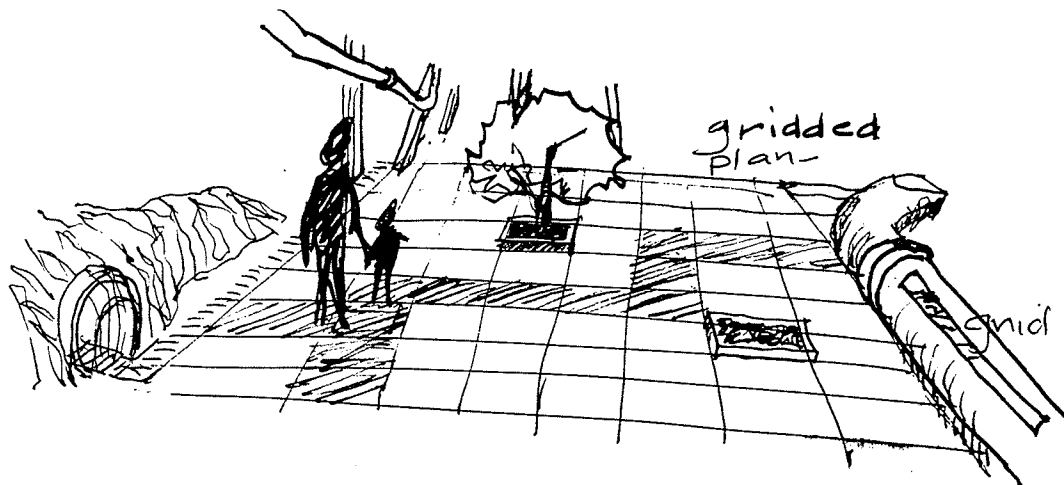
## Design Description

IMAGE (see Figures 56 & 58 )

- Theme of water is clearly evident: from inside the museum the 'lake' and the 'cloud' are primary focal points; from beyond the museum property, the cloud, the mountain and the water tower, create memorable landmarks. This is further reinforced by sounds of water splashing and by the river channel that disappears behind the fence. The bit of the river channel that flows outside of the exhibit has the dual purpose of allowing some participation in the exhibit, and creates a draws people toward the exhibit space, where people can get a better glimpse of what's going on inside.
- Water as the central focus acts as a spine and the heart of the display - flows and connects all activity area, reinforcing the notion of interconnectivity: Boundaries and borders are strictly artificial when it comes to natural resources. The strength of its presence is derived by the pure arch of the circular river which is softened by the undulation fence.
- Distinctions between the man-made exhibits and the natural are the result of textures, materials and degree of contact:
  - Natural cycle: These areas are characterized by amorphic forms and shapes of surfaces and walls, winding pathways, greater opportunity for physical contact with water. Attention drawn by the sound or site of water, and an invitation to touch and play with it.
  - Man made cycle: Characterized by more geometric forms and paths, exhibits housed in structures which are often constructed above grade, as if raised on stilts to further emphasize the notion that the man made world is imposed onto the natural, and less physical contact with water since water mostly flows through pipes ( you can hear and see it, but cannot touch it). Manipulation of water is most often achieved by buttons, levers and wheels.
- The water tower provides an overview point, from which to see all the activity spaces and their relationships.
- Where possible parallels are made possible between manmade and natural processes: for example the treatment activity is located adjacent to the exhibit on percolation, which deals with natural cleaning processes; the run off and erosion exhibits are situated near the land drainage and hard surface run off to illustrate the difference between surface runoff and piped runoff.



### Natural Areas



### Man-made Areas

FIGURE 54: Characteristics of Each Zone

- Three dimensional spaces and varied elevations help signify the multi-dimensional aspect of the water cycle.
- The combined interpretive techniques of animation, analogy and simulation are used to create the learning experiences beginning with the mountain, river lake and cloud which form a framework for the exhibit.

ACTIVITIES (see Figures 52 & 53 for a detailed description of the activities)

- messages directly relate to our use and control of water, but in order to be non-prescriptive, they merely allow opportunities to witness interactions and begin to understand. The overall message may not be clearly evident and may require the assistance of a facilitator or repeat visits to make it clear.
- presented in as real a scale and context as possible - magic and fun are derived out of the materials, colors, relationships and support activities.
- provide a wet and dry area
- *complex layering of information.* Most lessons are presented through non-literate means, such as symbols, illustrations or demonstrations. For the younger kids, or the young at heart, the activities may be enjoyed simply for their entertainment value, and the potential lessons may be slowly pieced together over subsequent visits. For older kids, who are starting to understand relationships and notions of cause and effect, there is the potential for them to uncover and realize some of the complex relationships that are being interpreted or, more in-depth thought can be provoked by introducing simple question or comment panels such as: "How do we ensure that the water flowing into our communities is clean and safe?", which introduces the idea of control, wise use, management and communication with those up stream, and reminds us to respect those down stream.
- *multiple opportunities for learning experiences:* The activities provide a fun playful learning environment on their own, but learning can be further enriched by using the site or aspects of it as the springboard for programming.
- *Playfulness* - playful accommodate all the 'releases' typically associated with children and the outdoors. (refer to notes under social interaction below)
- *Social interaction* - based on an average space requirement of 10 sq. ft ( .93 sq. m.) per person the activity spaces are design to accommodate the following types of interaction and the associated number of individuals at each space:
  - a) House: intended for independent or shared play
    - *main floor:* approx. 3 people per 'drain' - 10 people total
    - *basement:* mostly observational - 12 people total
  - b) Water tower: cooperative play, design pumping mechanism so that the more people who pedal, the faster the water pumps and the less work required.
    - *bicycles and pumps:* cooperative play - 1-2 individuals
    - *tower itself:* can accommodate a maximum of 16 people on the cantilever walkway
    - *chlorination:* 2 people.
  - c) the treatment plant: can be used for individual, cooperative or competitive play.  
Opportunity for role playing

- *enclosed chamber*: for use by 1 - 8 individuals -
- *open chamber*: space to accommodate up to 12 individuals
- d) under the street: intended for independent or shared play
  - climb up manhole - 1 person at a time
  - crawl through 'sewer' pipe - 1 - 20 people at a time along the length
  - cave area -
- e) the neighborhood street: open space intended for gregarious play
  - can accommodate 1 - 25 individuals
- f) the weir: intended for independent or partnered play, adjusting weir may require two sets of hands
  - accommodate 1- 2 individuals
- g) runoff: design for cooperative, competitive or independent parallel play
  - minimum 2 individuals to man controls, approximately 6 - 14 individuals
- h) percolation:
  - the pump: 1 person
  - provide a number of independent and shared play opportunities - accommodate 1- 6
- i) evaporation: intended primarily as an observational area with one or two independent activities
  - accommodate 1 - 10 individuals

PATH ( see Figures 56 & 57)

There are two primary paths in the exhibit space: one is the flow of water, the second is the pedestrian movement. The pedestrian paths links the exhibits physically, while the movement of water connects the stages conceptually, illustrating literally the flow and movement of water through the cycle. Water becomes the thread that ties the exhibits together: the unifying element.

- The intersection of the two paths is one device used to differentiate the man-made cycle from the natural. In the man-made, pedestrian movement runs parallel and adjacent to gridded network of pipes or enclosed conduits and does not offer much opportunity for physical contact, while in the natural, water flows in open channels and undulating configurations, pathways intersect with water courses and cross through (by way of step stones) the water as often as possible.
- The flow between activity areas is laid out sequentially to reinforce the learning process. Because water creates the conceptual linkages between the stages, it is not necessary that the pedestrian movement follow the same path. While the primary path does follow the water movement, numerous secondary paths need not..
- Level changes indicate the three-dimensionality of the world and is a necessary means of getting water to flow on site. It also provides an opportunity to see the world from above, below and within.

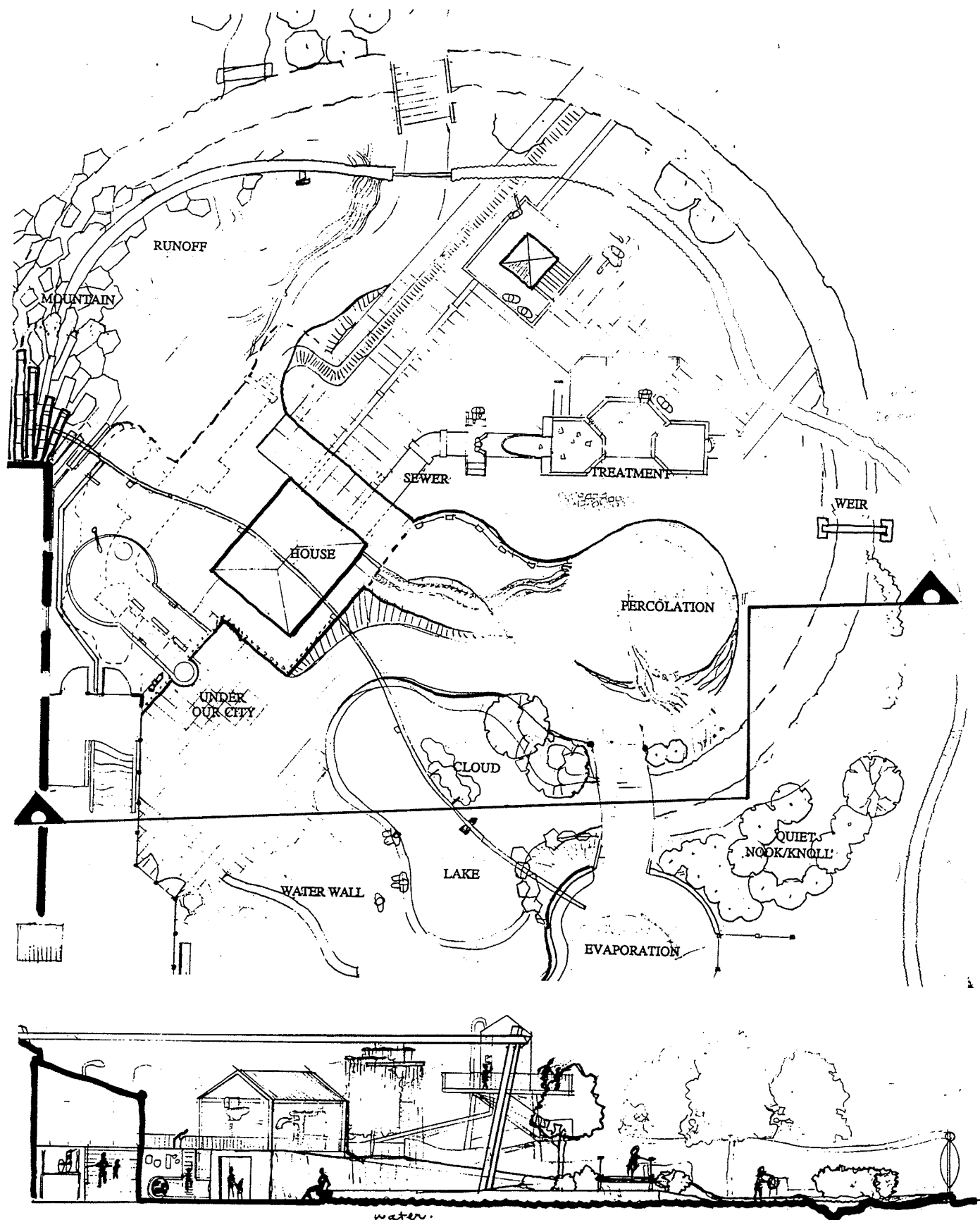
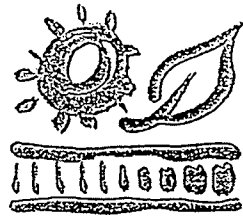
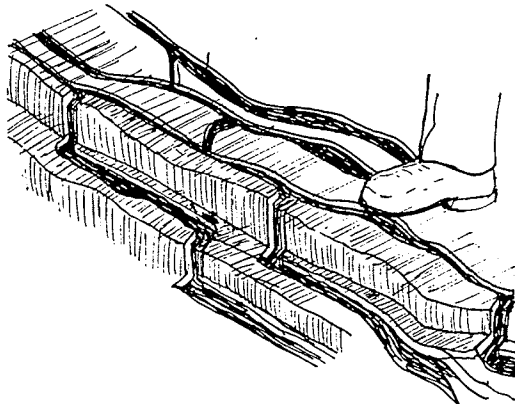
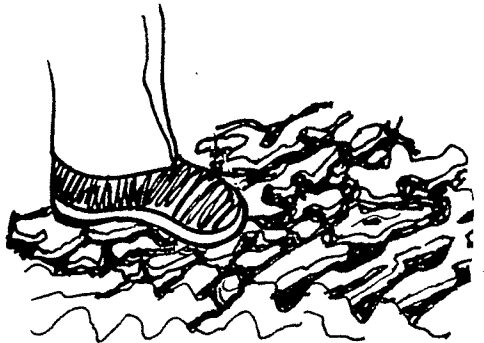
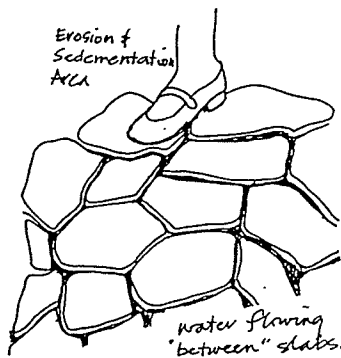
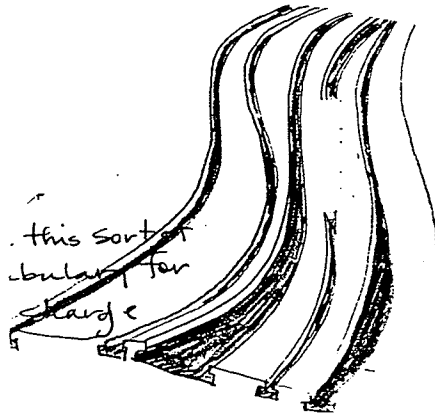


FIGURE 55: Site Section

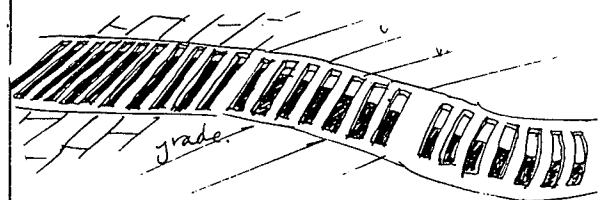
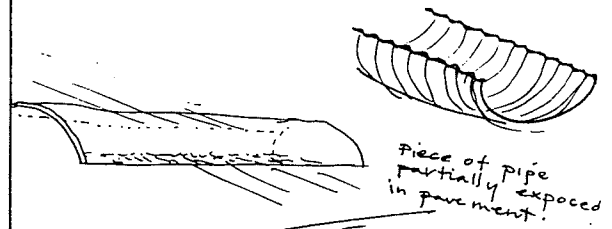
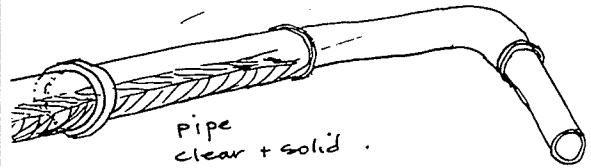


## Natural process Areas



## Manitoba Children's Museum

### Man-Made Process Areas



OVERALL NATURAL CYCLE  
MOUNTAIN TO LAKE VIA RIVER

EXHIBITS EXPLAINING NATURAL PROCESSES

- A) RUNOFF/EROSION/SEDIMENTATION
- B) PERCOLATION/TRANSPIRATION
- C) EVAPORATION

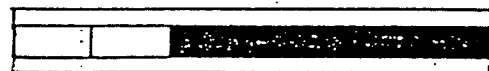
MAN-MADE CYCLE  
WATER IN PIPES AND CONDUITS

INTANGIBLE PART OF THE NATURAL PROCESS

THE CLOUD

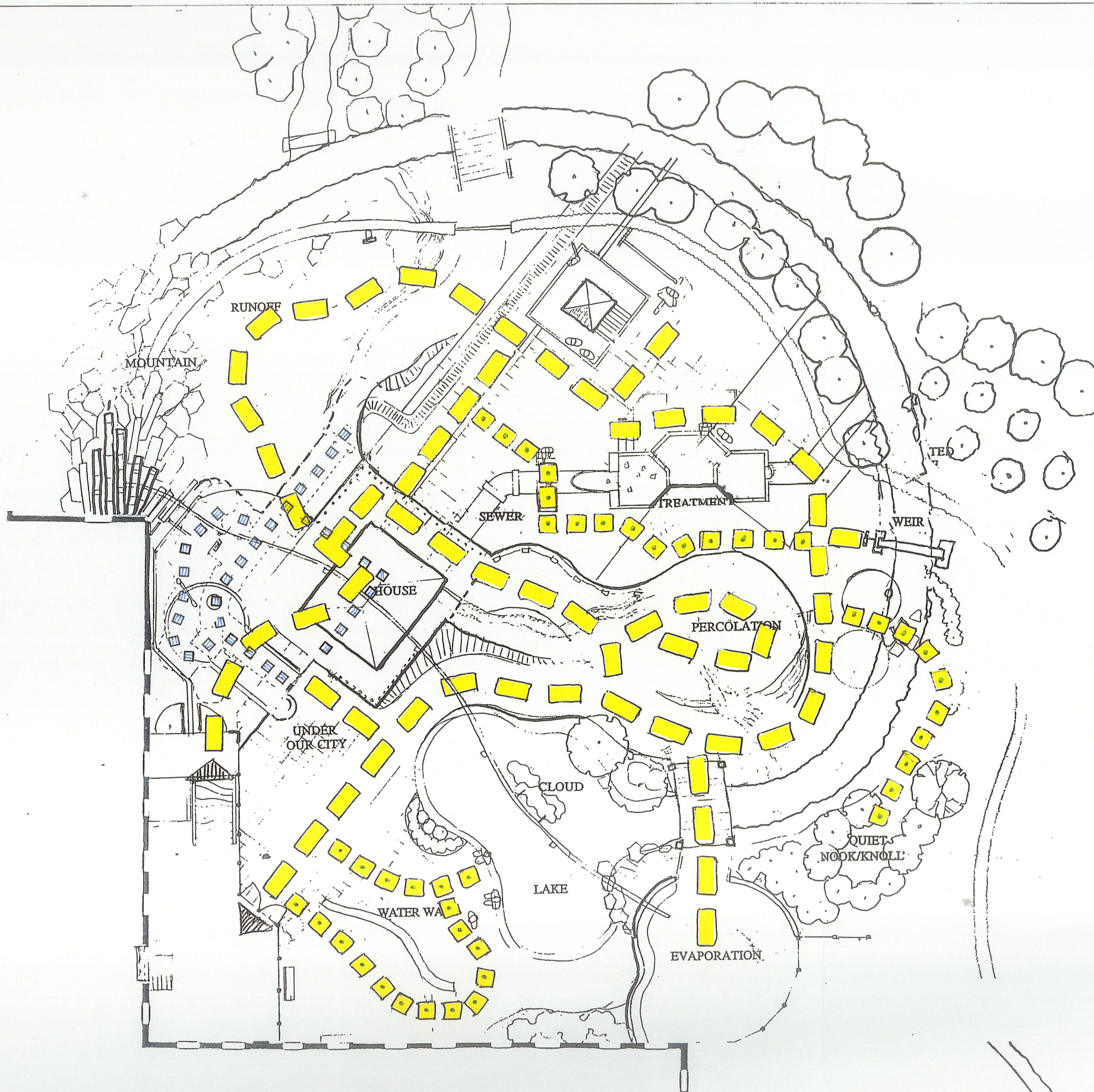
FIGURE 56:  
WATER CIRCULATION PLAN

5 0 10



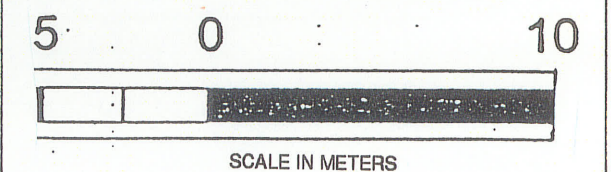
SCALE IN METERS



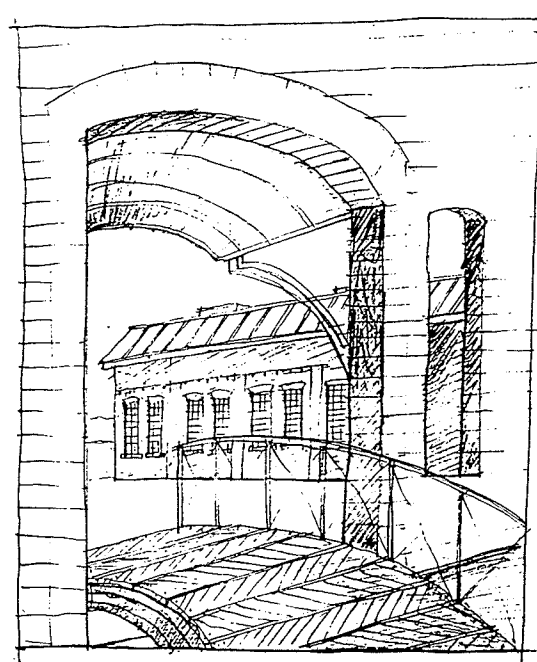


- PRIMARY CIRCULATION PATH
- SECONDARY CIRCULATION PATH
- LOWER LEVEL CIRCULATION

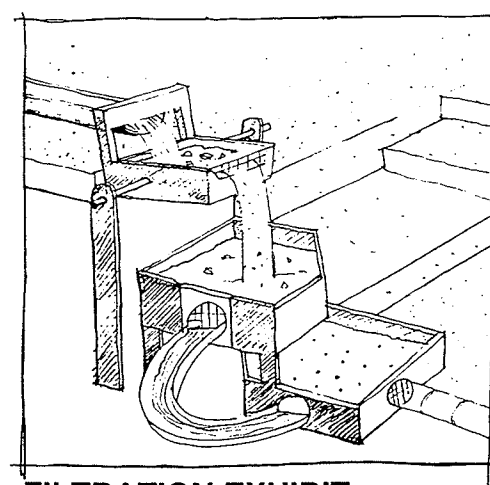
FIGURE 57:  
PEDESTRIAN  
CIRCULATION PLAN



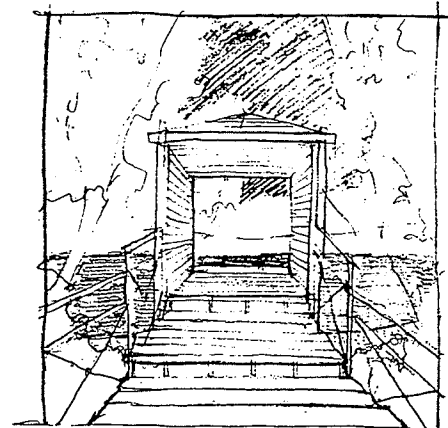




ENTRY TO EXHIBIT -  
BRIDGE TO EXTERIOR



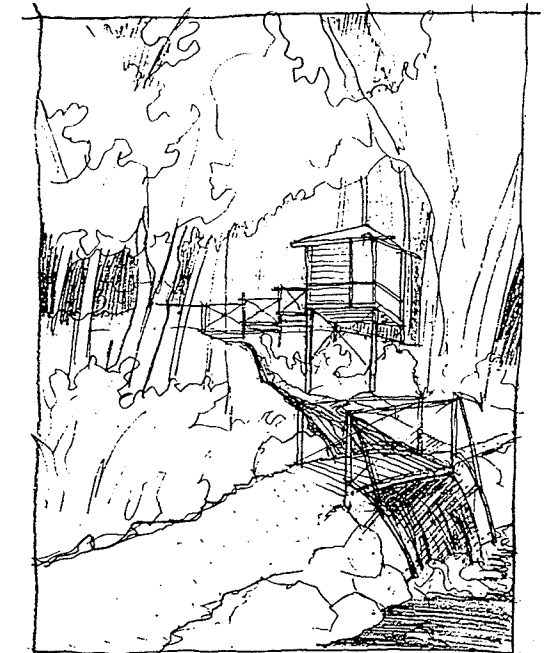
FILTRATION EXHIBIT



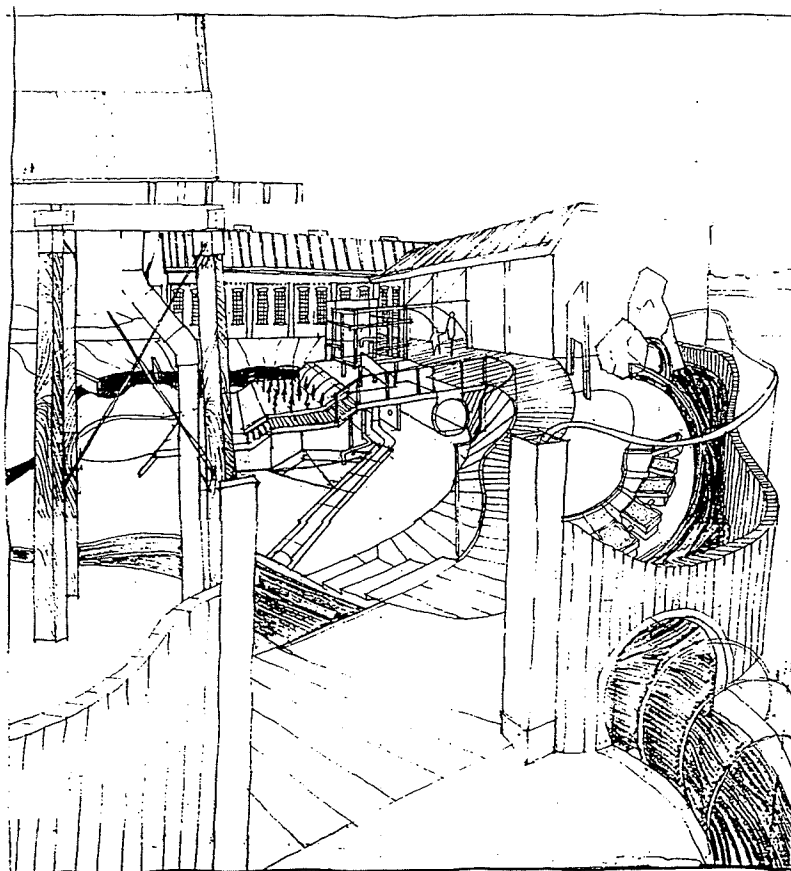
NATURE WALK TERMINUS



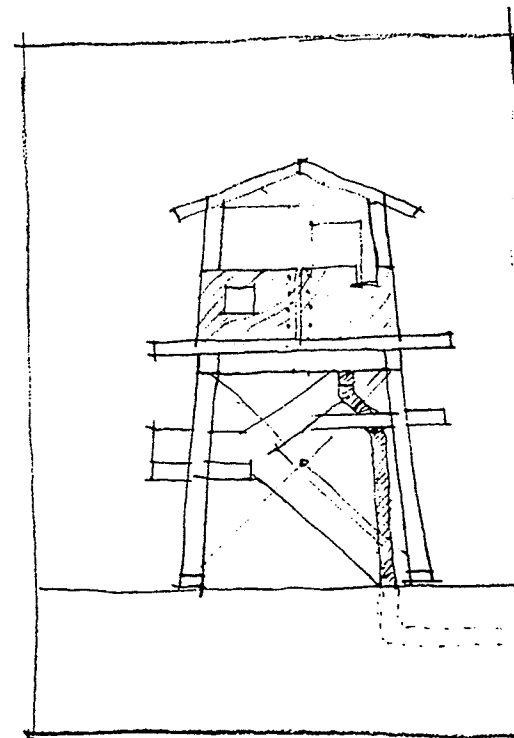
RIVERBANK CANOPY



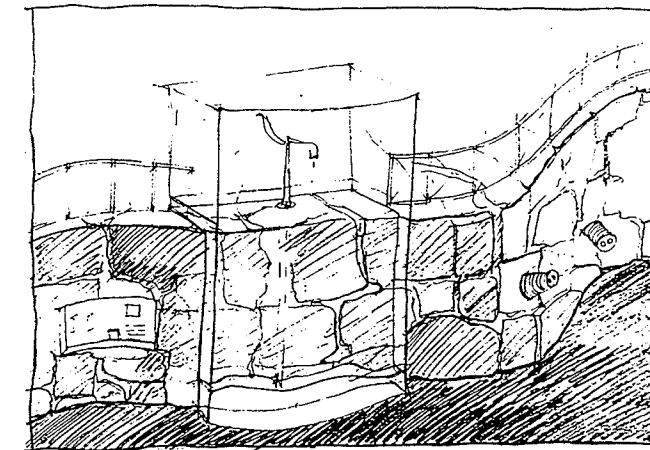
RIVER OVERLOOK



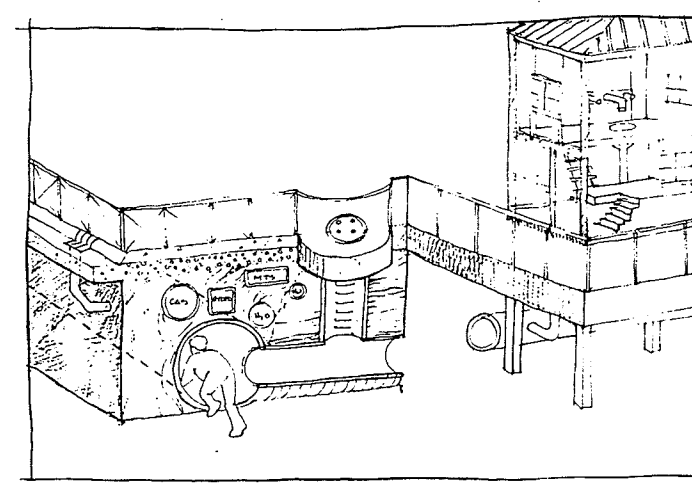
PERSPECTIVE FROM GATE



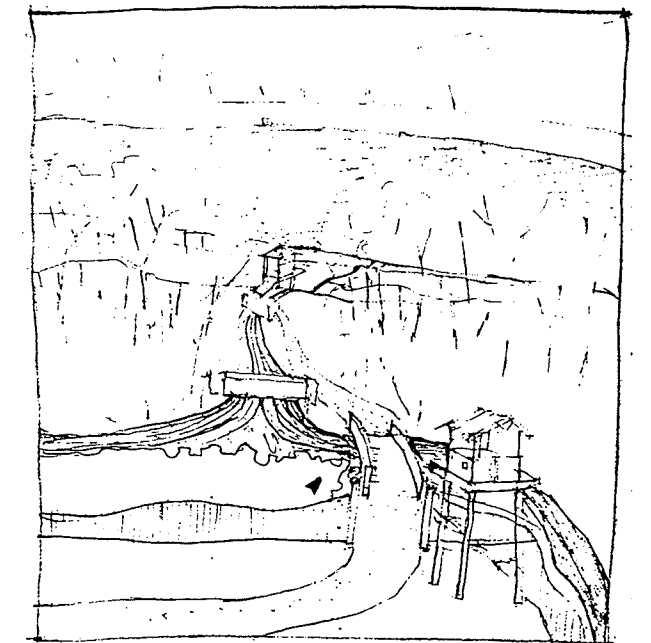
WATER TOWER



GROUNDWATER WALL - PERCOLATION

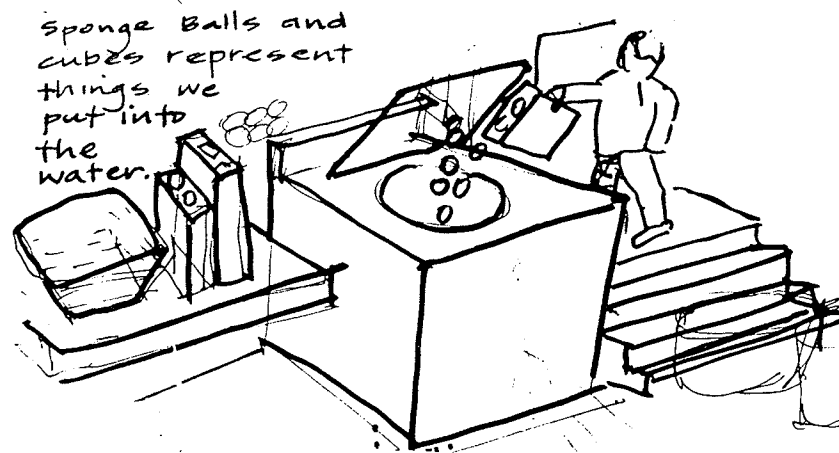


URBAN WATER SYSTEMS &  
CITY INFRASTRUCTURE

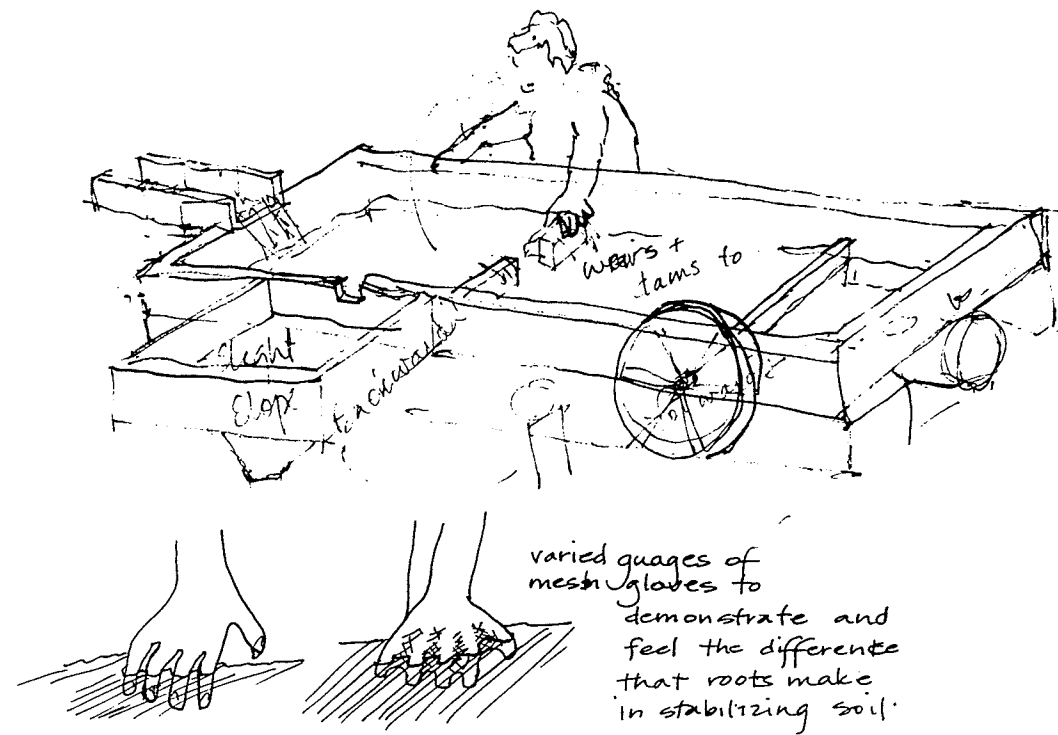


VIEW TO NATURE WALK

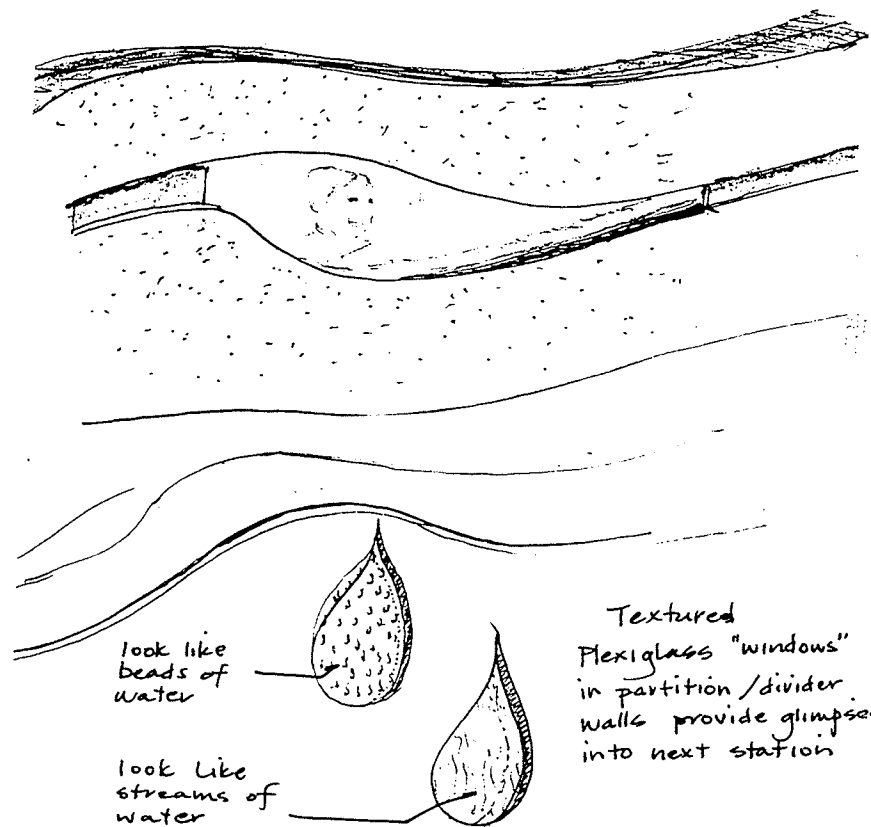
FIGURE 58:  
PERSPECTIVE DRAWINGS



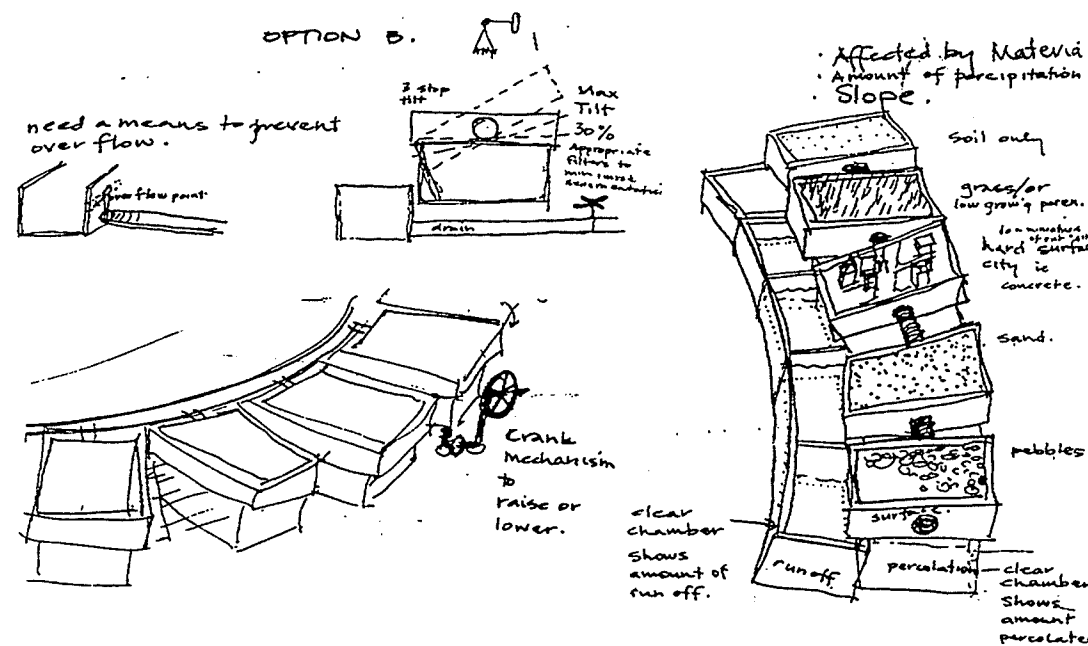
**USING WATER AT HOME:** allows for role playing; doing the wash like mom or dad. Sponge items or dyes can be poured into the 'washing machine' or 'down the toilet' and then followed through the pipes to the treatment plant.



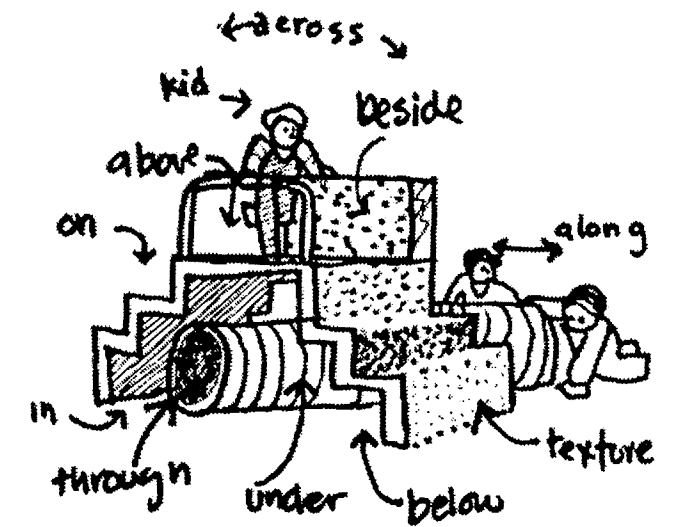
**EROSION:** Children are given control over the slope of the surface and the intensity of water, this time flowing across it. With webbed gloves and various damming devices they can witness how roots act similarly to constructed devices.



**WINDOWS:** in walls or barriers, give glimpses or impressions of spaces beyond. Interesting shapes and textures support the fact that the exhibit is about water.

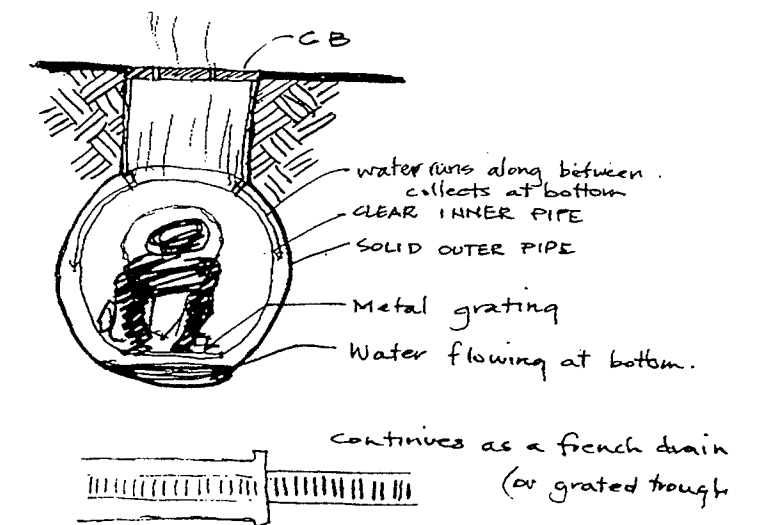


**RUNOFF:** Ability to control water flow intensity, surface material and surface slope help people to understand the difference that soft landscaping has on percolation. An overlap with the percolation area exhibits is important to relate the two concepts.



**THREE DIMENSIONAL SPACE:** besides the functional importance of being able to show the movement of water underground, it also allows for a variety of spatial experiences.

(Source: Moore et al. pg.65)



**LAND DRAINAGE:** A Culvert that kids can walk and parents crawl through.

**FIGURE 59:**  
**EXHIBIT DESIGN IDEAS**

## Seasonal Opportunities

As water transforms and has a different significance in each season so will the exhibit environment - changing - growing with the seasons.

- Spring

Noted for lengthy period of thaw, where standing water transforms the landscape. Much can be learned by observing the flow of water along the curbs, the effects of weather on evaporation. These changes and the beginning of plant growth make the forces of nature most clearly visible. Opportunities to observe the changing levels of the river should be taken advantage of.

- Summer,

Offers greatest exploration. Weather makes outdoor activities the dominant and preferred form of play in summer. Water levels experience periods of fluctuation related to the weather particularly precipitation and humidity.

- Fall:

Leaves turning color and dropping is perhaps the most dramatic of regular natural events - exciting, beautiful, and instructive. Daily changes occur, and distinctions between species become particularly evident (color and time of drop). As temperatures drop and litter accumulates water presents a different character or mood.

- Winter

Because of the length of Winnipeg's winters this is the most critical and limiting factor in outdoor exhibit design. It is intended that the space be available for winter play, but with limited operation of the water cycle stations. It is important to illustrate that the water cycle continues in winter, but in a different way. The cross section of the 'river channel' is designed so that the lowest area can be heated, in order to maintain a small flow of water throughout the winter. Water flowing from the mountain can be maintained to create a delightful ice sculpture. This change of seasons is celebrated by the contrast of running water with its frozen river elegance.

Stations like the treatment plant take on a new role as a snow table. It can be design with different color surfaces, that helps illustrate how color absorbs heat (melts snow). The different surface types in the erosion exhibit provide a lesson on how surface material and slope impact snow accumulation, melt and runoff.

large thermometers can be stuck into varying depths of snow to explain the thermal capacity of snow, which can be the basis for discussion about how animals survive winter and winter safety

**Other opportunities for exploring cycles:**

Tadpoles are an excellent example of transformation and change and can help to extend the idea of cycles to more tangible living species. These could be housed in the 'lake' and monitored informally and through special programs.

Plant material offers an ideal means of discussing life cycles as it changes through the seasons. Selection and placement species with specific features can help to accentuate the seasonal transition.

## Chapter 8.0

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# S U M M A T I O N

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*"It is not enough that we as landscape architects behave and practice as though we are the stewards of the world we live in. As a profession, landscape architecture is too small to bear such a large burden. Instead, I feel that all people who share this planet are responsible for its welfare. Without the cooperation and dedication of all people, or at least a vast majority, landscape architects will ultimately fail as stewards of the earth. It is for this reason that we must turn to education. It is not enough that we practice good stewardship in our profession. We must also endeavor to teach the goals and practices of good stewardship to all the other people we come in contact with. . . . We must strive to enlighten them of the need for and the ways of good stewardship."*<sup>1</sup>

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<sup>1</sup> Bob Steuer (2nd yr. MLA), "Beyond Stewardship" from Georgia Landscape, a newsletter published by the School of Environmental Design in Athens, Georgia, Spring 1991, pg. 12.

The intent of the project was to determine an appropriate context for learning about the complex relationships that exist in the natural environment, with an emphasis on processes of the urban environment. The ultimate goal is to increase participants environmental literacy, and help nurture a sense of environmental ethics.

Ideally, it would be best to educate children about the natural processes, in this case water cycles, by witnessing the processes that go on around them. However, it is difficult to comprehend such things as continuous flow or cause and effect, not to mention less tangible concepts such as percolation and evaporation when the natural processes take place over such a long time period and expansive area.

In hindsight, the design problem might have been better stated as "how do you help a child understand the importance of interaction and cause and effect in the natural world when they have only a limited understanding of time and space?" The proposed design attempts to minimize the influence of time by condensing the processes into an illustrative model operating within a controlled setting. To accomplish this within the established objectives meant creating a playful learning setting that animates the processes and provides analogies or draws parallels to the real world.

Though this project focuses on children ages 5-11, the primary audience at children's museum, it also serves the needs of all other ages who visit the museum as observers or participants (both willing and otherwise). For the younger children and even some of the older ones, the intent of the exhibit - that it is representative of the water cycle - will likely not be immediately evident. Many will be entirely consumed by the individual activities and features. The 'trick' then is to make the experience interesting enough and offer enough variability to entice varied users and more importantly encourage repeat visits. With each visit, greater understanding and appreciation is possible. This is achieved in part by allowing the participants to modify some aspects of the exhibit, as part of the educational process. Some examples include: a) the weir, it allows for changed water levels and potential flooding which changes the character and usability of the space, b) the runoff exhibit is infinitely variable since the child can change volume of water, intensity of flow, and slope of surface, while c) the erosion exhibit allows people to create new and interesting patterns in the crushed particles. Opportunities to modify the actual character of the place, change water levels, change water flows throughout the system, not to mention variability of an outdoor environment as a result of sun light, temperature, and plant life makes for a completely different experience each time. This adds intrigue and enjoyment to the exhibit space.



From an environmental education perspective, development of this exhibit is based on the idea of synergistic interaction: as an individual's values and actions change, he becomes open to a broader range of potential change. This is the first step to developing environmental ethics. At the most basic level, the exhibit provides an interactive, entertaining educational experience. The 'environmental concepts' are derived through awareness of relationships, discussions, facilitation and programs that draw parallels to environmental issues and ecological practices. The exhibit space development is therefore merely a point of departure for becoming sensitized and developing a greater understanding of the environment in which we live. As an educational framework, it also serves as a point of departure for elaboration on numerous issues.

This introduces one of the biggest challenges with environmental learning - determining 'indicators'. How does one know if the 'right' message is getting through? This is particularly difficult in an exhibit that tries to be non-prescriptive, but identifies issues and raises questions, and avoids pinning such labels as right or wrong to any learning. In the early stages it is fair to say that any indication that the concepts and processes are recognized and applied in contexts outside the museum setting, would demonstrate that a minimum level of comprehension has occurred. It is important that teachers and parents help establish the relationships between the exhibit and the real world by pointing out elements and processes in their local communities that the exhibit interprets. This would include such things as a working water tower and the city's reservoir, a treatment plant, pointing out manholes and drains as well as watching water coming out of a down spout to see where it goes.

The museum can also incorporate programs and strategies to help children understand the concepts. One concept might be to have collectible puzzle pieces from each activity to take home. This can help put the pieces of the exhibit experience into one conceptual framework, acting as a reminder and reinforcement of learning.

### Further Development

*Detailed design:* Since this project only presents a conceptual design, there are numerous details that require ongoing refinement. This would be best accomplished with the combined expertise of an exhibit designer, educational psychologist, environmental educator and hydrologist, as well as the continued consultation of the landscape architect.

*Health and Safety:* As part of the detailed design, the issue of water safety would need to be addressed. As well, since the water that flows into the exhibit space is partially outside the exhibit limits, cleanliness and health issues would need due consideration. It is possible that the importance of testing water quality be incorporated into the exhibit experience.

*Outdoor environment through winter:* While the impacts of the visual affects of the exhibit and some educational opportunities in winter have been considered, there is another issue that was not within the scope of this project but which warrants in-depth study: the whole aspect of transition from indoors to outdoors including such things as where to store coats and boots, and how

*Integration of the other cycles.* Greater understanding of the complex interplay of cycles and systems could be further enhanced by developing complementary exhibits on the energy cycle, mineral cycle or air cycle.

*Extensions (interpretation) throughout site.* The museum can establish satellite displays throughout the forks, particularly down in the riverbank terrace or along the walkways, which related to the water cycle exhibit or environmental systems in general. This serves to extend the learning opportunities to even greater informal contexts, as well as provide an introduction or preview to the museum. Direct relationships to specific museum exhibits can be attained by using unique symbols, graphics or icons to help children make the connections.

*Design for a closed system:* An interesting elaboration of this exhibit would be to design it to operate as a closed system; meaning that everything would run on a fixed amount of water cycling through. In this context any over use or hoarding in one exhibit would mean there may not be enough for another area. Though this could become highly elaborate and therefore not necessarily appropriate for the children's museum context, it would make an enticing game dealing with the fair and equitable use and management of a resource, forcing sharing and team work and would also bring about discussion and decision making that considers needs versus wants. Detailed hydrological design would be required for something of this complexity.

• • •

As professionals who claim to provide and encourage stewardship of the natural environment, this background has merit in helping landscape architects establish where their responsibilities lie with respect to education and what can be done in practical terms to help impart environmental messages. Through design, landscape architects attempt to unconsciously control or modify how people experience the environment by manipulating the encounter; in essence they strive to make people perceive differently.

The proposed exhibit environment represents just one effort or component of a larger global effort to achieve comprehensive environmental responsibility, by raising the level of interaction, awareness and understanding by children and their accompanying caregivers. A challenge in environmental education lies in the fact that focus revolves around two constantly changing variables, people and environments. Into that process is incorporated another level of 'universal' change - environmental sensitivity. As human consciousness expands this exhibit framework may, in time, become a valuable springboard for greater elaboration on the notions of "sustainability".

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# *A P P E N D I C E S*

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## APPENDIX A: Characteristics Of Children

Table 1: Characteristics of Pre-School and School Age Children

	PRE SCHOOL (2 - 7 Years)	SCHOOL AGE (7 - 10 Years)
<b>PHYSICAL CHARACTERISTICS</b>  Weight Height Step height Sitting height head circumference Index Finger diameter	Range: 14-21 Kg Range: 900 - 1200 mm Ave. 6 yrs: 500 mm Ave. 6 yrs: 640 mm Ave. 6 yrs: 510 mm Ave. 6 yrs: 11.0 mm	Range: 20-30 kg Range: 1100 - 1350 mm Ave 9 yrs: 560 mm 700 mm 520 mm 12.2 mm
<b>CHARACTERISTICS OF THE AGE GROUP</b>	<ul style="list-style-type: none"> <li>• Governed by play</li> <li>• Pre Logical Thought</li> <li>• Sensory dependent</li> <li>• Symbolic communication</li> <li>• Ego Centric: spatially, morally; governed by perception</li> <li>• Active, energetic: in perpetual motion</li> <li>• Curious: want to find things out</li> <li>• Morality based on reward and personal benefit, and avoidance of punishment</li> <li>• Short attention span</li> <li>• Individualistic, possessive</li> <li>• highly creative and imaginative</li> </ul>	<ul style="list-style-type: none"> <li>• Logical Reasoning</li> <li>• Problem Solving Abilities possible</li> <li>• Rely on concrete experiences</li> <li>• Cannot comprehend abstract notions</li> <li>• Still active, developing and enhancing fine motor skills through sports and games</li> <li>• Morality governed by ability to understand others: empathy &amp; fairness</li> <li>• Developing Independence and responsibility</li> </ul>
<b>DEVELOPMENTAL NEEDS</b>  Intellectual   Emotional   Social   Physical	<ul style="list-style-type: none"> <li>• to create and explore</li> <li>• to make choices, help make rules</li> <li>• to share and evaluate</li> <li>• Engage in symbolic and fantasy play to test ideas and knowledge of their environment. Learn through trial and error.</li> <li>• comfort and familiarity</li> <li>• appeal to morality by making things rewarding and personally beneficial</li> <li>• Opportunities to play alone, to observe and to figure out and assimilate newly learned ideas.</li> <li>• play alone or in small groups</li> <li>• to cooperate</li> <li>• opportunity to play out fantasies, to pretend</li> <li>• Opportunities to use language and non-verbal communication for social interactions during play</li> <li>• like to respond to rhythmic sounds</li> <li>• to participate in vigorous activities</li> <li>• wide range of activities, which the child can change frequently</li> <li>• Require small scale equipment suitable for their developing competence and size.</li> <li>• open space areas to run jump skip and expend energy</li> </ul>	<ul style="list-style-type: none"> <li>• ability to think clearly &amp; solve problems and understand concepts</li> <li>• opportunity to group and classify items</li> <li>• Work on projects, solve problems, experiment with a wide variety of objects.</li> <li>• reinforce feeling of self worth &amp; sense of belonging</li> <li>• degree of independence, of personal power, of having some control</li> <li>• Relaxing places, allow children to engage in quiet activities or watch others play.</li> <li>• social acceptance, knowing that others approve</li> <li>• opportunities to develop cooperative skills and competitive behavior</li> <li>• Need unstructured as well as structured opportunities to play together, chat or do nothing in particular.</li> <li>• free range activity and games with rules</li> <li>• opportunity to refine dexterity</li> <li>• Wide variety of physical activities and games developing dexterity and self confidence. Physical play can be noisy.</li> </ul>

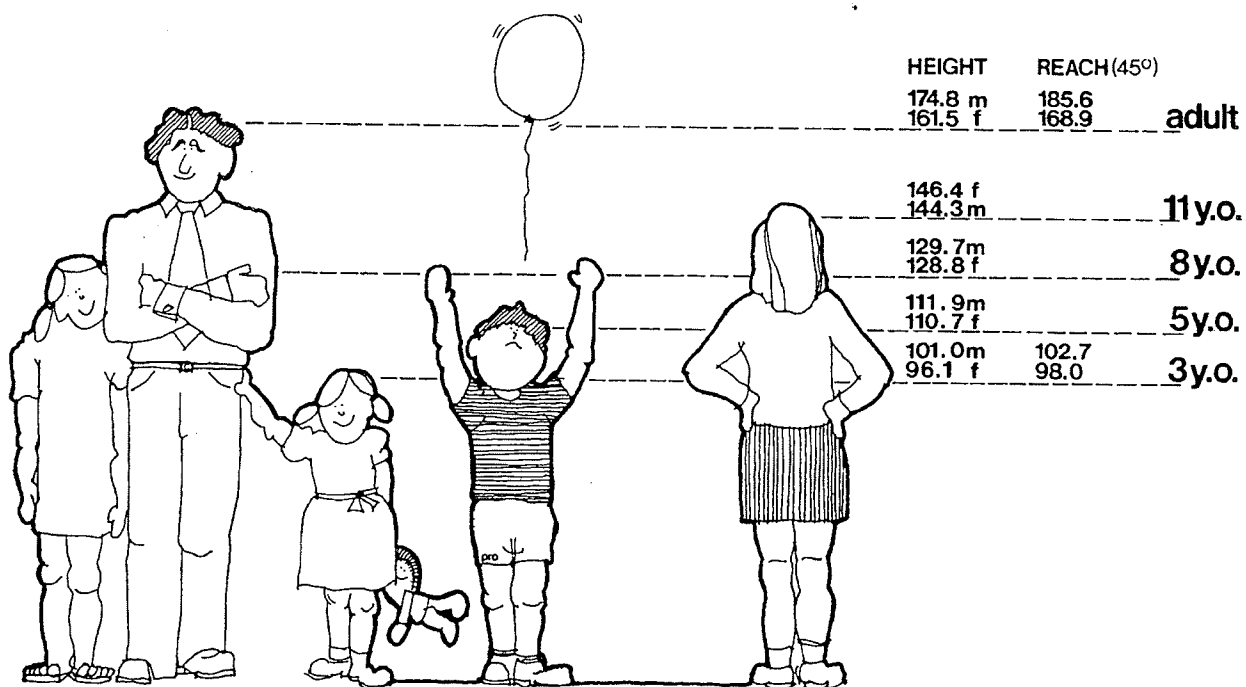


Figure 60: Anthropometrics: The Average Height and Reach of Children in Centimeters  
(Source: Barnard, p.58)

## APPENDIX B: Local Environmental Education Programs

One of the intentions of the design proposal for the Manitoba Children's Museum was to complement, but not duplicate programs that exist within and around Winnipeg. The following outlines the major facilities and how they address environmental education. This is intended to be illustrative, as such it is not a comprehensive representation.

### Fort Whyte Nature Center

#### Mandate:

*"to provide funding and facilities for education in the art and science of keeping this planet habitable for all forms of life."*

This 'natural urban oasis' focuses predominantly on species and natural habitat, and is a working demonstration of effective land reclamation. It is a privately operated, non-profit project of the Fort Whyte Foundation Inc., located in the south central area of Winnipeg. It is situated on a reclaimed clay quarry, adjacent to a cement factory. The 200 acre site is comprised of forest, manmade lakes, marshes, boardwalks, and self-guided tours. The trails provide interpretive details for the agricultural demonstration plots of native prairie, shelter belts and Manitoba's field crops; as well as information regarding habitats for white tail deer, mink, fox, raccoons, song birds and waterfowl. The Compost Education Trail provides a working demonstration of the myriad of methods for recycling, while reinforcing the importance of the process.

Since being incorporated by special act of the Manitoba Legislature, it has evolved from nature center to conservation center to environmental education center. The Interpretive Building (10,000 sq. ft) houses numerous displays and exhibits: underwater window of Manitoba's aquatic life; detailed diorama depicted prairie soil evolution, Interactive Energy Encounters exhibit, waterfowl wintering room, gift shop, lecture theater, school and youth groups. The center is enjoyed by 100,000 visitors annually; including families and school groups. Many just like to walk around, others like to participate in the programs.



### Kinsmen Discovery Center

#### Mandate/Purpose:

*to present a family atmosphere to learn about animals and their habitats in a fun, interactive manner. Animals are shown as part of an environment rather than simply as isolated animal specimens.*

Located in the Assiniboine Park Zoo, this was developed as a cooperative project between the Zoological Society of Manitoba, the Kinsmen Club of Winnipeg, and the City of Winnipeg, with additional funding coming from Federal and Provincial Governments, the Winnipeg Foundation, and an anonymous donor.

It is a linear, self directed indoor exhibit, spread through a series of buildings with the following habitats demonstrated.

Water Zone: Cichlid (carnivorous fish), goldfish, lungfish, poison arrow frog, prehensile-tailed skink, marine toad, axolotl (salamander);

Rain forest Floor: Trumpeter bird, acouchi (rabbit sized rodent), red/yellow footed tortoise;

Forest Canopy: White faced marmosets (monkey), tree snakes

African Savannah: Meerkat

Cave: Blind Cave fish, Cockroaches

Flight Area (Bat Glade & Bat Cave): Fruit eating bats, Senegal bushbaby

Barn: domestic animals, and birds most available for petting.

### Living Prairie Museum

In Northwest Winnipeg, St. James/Silver Heights area, tucked into the corner of a residential area is a 16 hectare outdoor museum. The site represents one of the last remaining examples of tall grass prairie in Manitoba (one of few remnants of virgin prairie land in North America). It contains some 200 native plant species, including many rare and beautiful varieties. One such flower is are protected here, including Manitoba's own floral emblem, the prairie crocus. The museum has an interpretive center containing displays , slide shows hands on activities for children. Interpreters are available to provide guided hikes through this living classroom, preserved to benefit the children of today, tomorrow and yesterday.

### Delta Marsh

Located on the Southern Shore of Lake Manitoba, it contains 48,000 acres of marshland south of an ancient beach ridge. Only 43% of Delta Marsh is available to the public (i.e. hunters). It exists in part due to centuries of water from the Assiniboine River channel, which crossed the fertile plains to enter Lake Manitoba. As was characteristic of such delta deposits, rich sediments provide the basis for wildlife habitat and productivity. Research and education is provided by the Delta Waterfowl Research Station and the University of Manitoba Field Station.

### Oak Hammock Marsh Wildlife Management Area

Oak Hammock Marsh is an interpretive center which exposes visitors to a thriving wetland and is renowned as a spring and fall staging area for geese and ducks and countless other migrating birds. This 3500 hectare property located, 40 km north of Winnipeg, is home to tens of thousand of wildlife including 280 species of ducks, geese and shorebird that rest and feed in the area. It represents the remaining portion of the St. Andrews Bog (47,000 ha) which at one time was one of the largest prairie marshes. Settlers managed to drain and farm all but 250 ha.

The site includes marshland, grassland, and lure crop areas, the largest piece of unbroken tall grass prairie (24 hectares) in the province and an artesian well featuring 28 km of trails, boardwalks, observation decks, picnic area, and a cafeteria.

Developed in the 1960's as a cooperative venture between Ducks Unlimited, & Federal Government, it strives to promote the conservation of wetlands through exhibits, remote cameras in the marsh, guided walks, canoe excursions, weekend workshops and indoor and outdoor programs. Seasonal interpretative programs provide guided tours and special events to foster and understanding and appreciation of the importance of wetlands and wetland management. This is a managed marsh, meaning measures are taken to perpetuate its existence: it is drained and flooded periodically to revitalized marsh soils and encourage recolonization.

## In School Systems

Many of the School programs are focusing on establishing garden and compost areas, of planting trees, or testing ground cover alternatives as strategies. These activities have the specific intent of to demonstrate the natural regenerative cycle of plant life, and to teach them the simplicity of non-chemical, self supporting food. (self sustaining processes). Fun, rewarding, educational, not just with respect to increased understanding of ecological concepts, but can be used to discuss math concepts and for those who are interested perhaps act as a catalyst for writing.

### A.I.M. - Aquatic Invertebrate Monitoring Programs

A collaborative environmental studies initiative by the Friends of Environmental Education Society of Alberta (FEESA) with support from the Alberta Environment. Designed to establish and aquatic invertebrate monitoring program for Alberta students which meet the curriculum requirements for Biology and Science. The program was developed for Alberta high school student and teachers to provide them an opportunity to crucially examine water related issues and in the process, to duplicate the field work of aquatic biologist.

Its educational mandate is governed by three important components:

1. Awareness, 2. Investigation, 3. Impact / Action

The course covers: the importance of water, use of water, and the impact of activities on quality. It establishes the importance of monitoring to ensure quality (mitigate pollution problems), identifies and explains the use of benthic invertebrates as a means of monitoring to determine quality and provides hands on biological studies of local freshwater environments. Comes complete with a video (slide - tape conversion), teaching resource manual, student manual, and invertebrate identification poster

## APPENDIX C: Outdoor Space Requirements for People

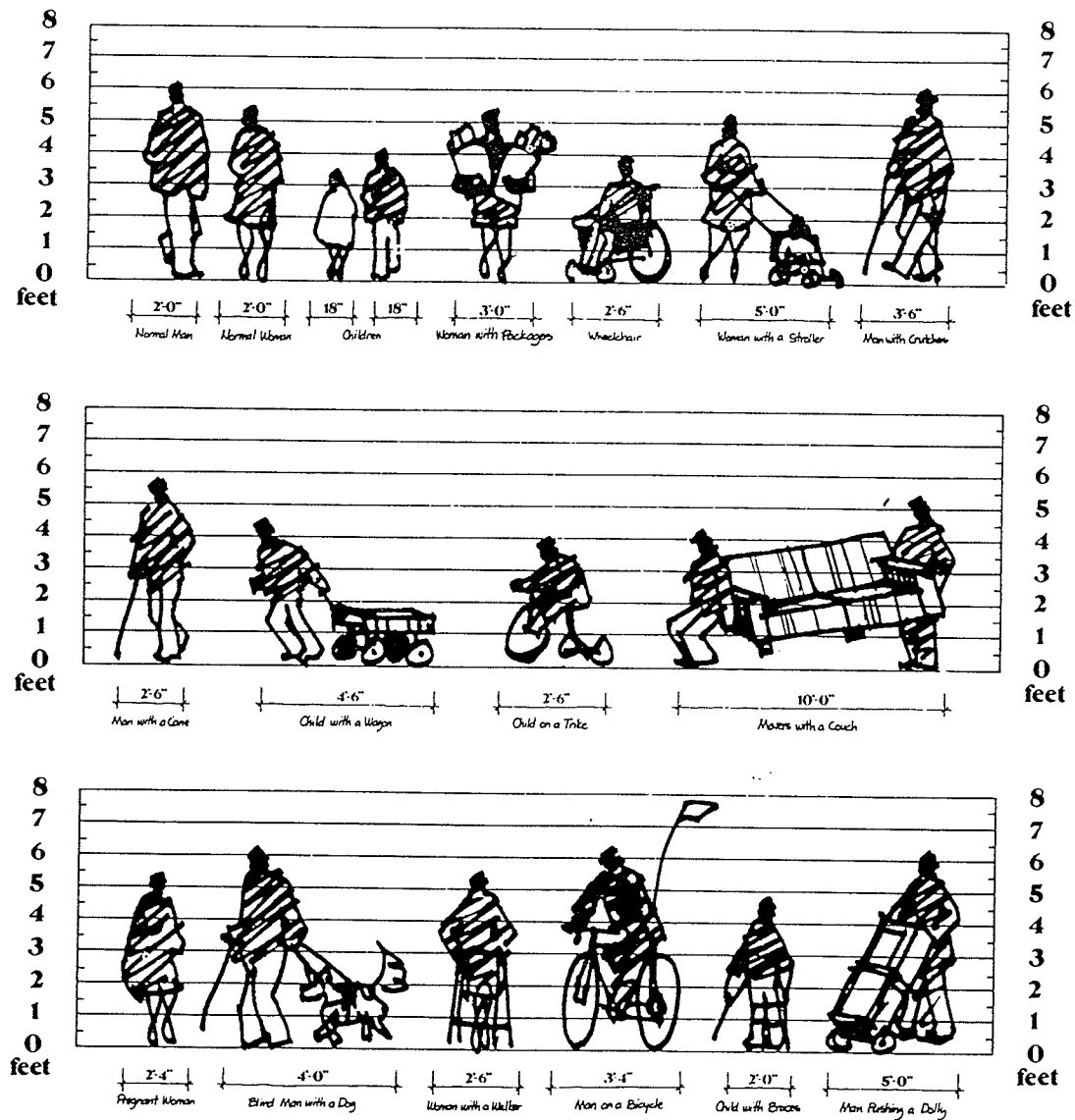
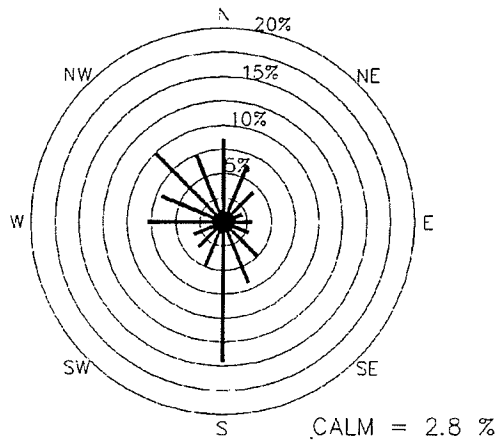


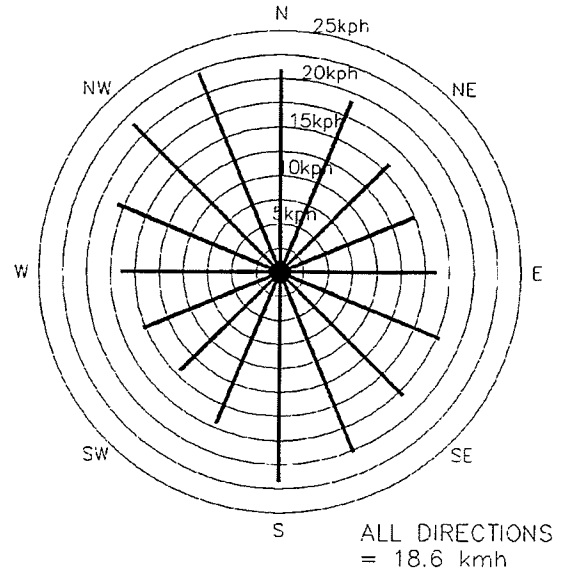
FIGURE : Dimensions for People Outdoors  
(Source: DeChiara & Koppelman, 1984, p.524)

## APPENDIX D: Wind Analysis:

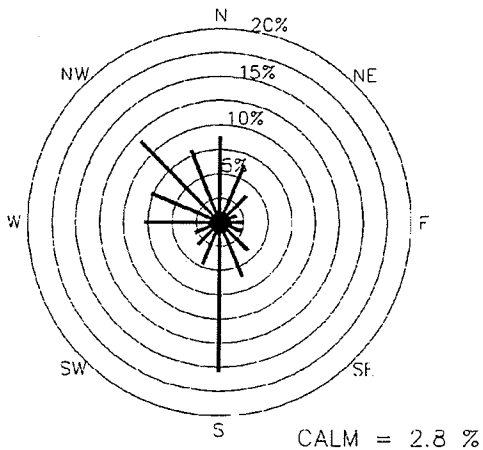
AVERAGE YEARLY  
WIND FREQUENCY



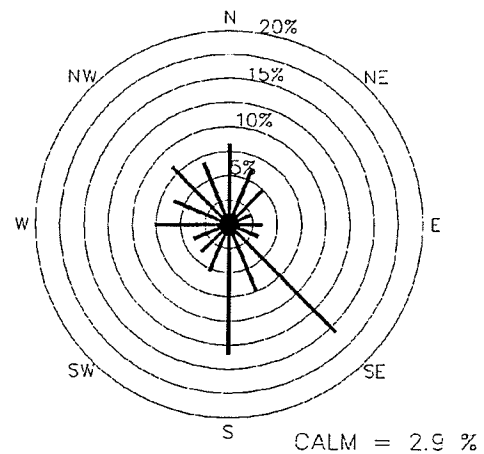
AVERAGE YEARLY  
WIND SPEED



WINTER WIND FREQUENCY  
(NOVEMBER - APRIL)



SUMMER WIND FREQUENCY  
(MAY TO OCTOBER)



WIND ANALYSIS FOR  
THE CITY OF WINNIPEG  
(1951-1980 DATA)

**IDS** I.D. SYSTEMS LTD.  
Environmental Consultants  
WINNIPEG, MANITOBA, CANADA

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## **APPENDIX E:      Annotated Bibliography On Exploratory Learning Approaches For Environmentally Sustainable Lifestyles**

The following literature review was undertaken to identify resources which provide the necessary background to complete a practicum studying the design implications for a discovery center approach to environment education. Its focus is shaped by four key premises: 1) the importance of developmentally appropriate 'instruction' and the promotion of non age-segregated interaction (children and adults learning together) 2) recognition of the need for an interactive, stimulating, uninhibited learning atmospheres, 3) the significance of an educational philosophy and approach which promotes inquiry, exploration and active involvement in natural processes, and 4) a desire to instill a sense of compassion and caring for the environment.

In response, research was conducted in the following areas:

### **1. Child Development, Learning & Educational Psychology**

An overview of the child development process, specifically between the ages of three to ten, focuses on the implications for learning and instruction. References look at the child's cognitive, physical and psycho-social growth as it relates to their ability to learn from and about the environment. The research touches on the important aspects of moral growth and the internalization of values, as well as the importance of play within the overall development process.

### **2. Children's Museum - Experiential/Interactive Learning Environments**

Describes and defines Children's Museums functionally and philosophically, and addresses their role in enrichment of the learning process.

### **3. Sustainable Development - In Search of a Definition**

A review of literature in order to gain a greater understanding and clearer definition of the concept of sustainability. Items reviewed included those which identify some of the key concepts which might help shape an educational agenda, and which reveal the inherent implications for reaching the public. An emphasis is placed on existing initiatives and proposed applications, for inspiration and guidance in establishing an educational program.

### **4. Learning about, with and for the Environment**

- Environment Programs in Museums and Discovery Centers
- Education Programs and Initiatives for Sustainable Development

Looks at efforts, theories and approaches to environmental education, awareness and action. Areas of review touch on how to motivate 'green' lifestyles and the importance of lifelong learning, both from the perspective of education in general and specifically as it affects long term environmental concern and advocacy. Identifies the strengths and limitations of existing environmental education programs, in order to determine how the concepts can be modified and enhanced for use in an interactive learning environment, and to assess how those concepts might be extended to address the notion of sustainable lifestyles.

Berger, Kathleen S. The Developing Person Through the Life Span, 2nd edition. New York: Worth Publishers, 1988.

A comprehensive textbook, complete with section summaries and key question, which breaks down the life cycle into seven phases: Infants and Toddlers, Play years, School years, Adolescence, and Early, Middle, and Late Adulthood. Within each phase, the three domains of human development; physical, cognitive and psycho-social development are discussed in detail, with emphasis on the importance of assessing and analyzing the three domains together. The front end provides background and comparisons of the leading developmental theorists and theories: the psychoanalytic, the learning, the humanistic, and the cognitive. The book is defined by the author as a holistic/systems/ecological approach to the analysis of human development.

Butler, Annie L., Edward Earl Cotts & Nancy L. Quisenberry. Play as Development. Columbus , Ohio: Charles E. Merrill Publishing Company, 1978.

This book provides insights into the nature and role of play, particularly in classrooms. It explains the importance of play from a developmental standpoint, providing detailed examination of how play impacts and shapes each of the child's developmental domains: "motoric" (27) - their understanding and mastery the physical environment; social - their development of communication and interactive skills; cognitive - their understanding of themselves as a unique individual; and affective - the nurturing of their creative capabilities. The book intends to illustrate how a teacher, who appreciates the skills of the learner as well as the impact that the environment has on them, may be effective in stimulating and guiding the child's development through play.

Damon, William. The Moral Child, Nurturing Children's Natural Moral Growth. New York: The Free Press: A Division of MacMillan, Inc., 1988.

Attempts to validate opposing positions on moral development: the need to indoctrinate children with moral values and the notion of leaving morality to child's own natural development. The book outlines the implications of each from a developmental and behavior standpoint, looking at early emotions, learning about justice, parental authority and cooperative play. The book's main thesis is that while children need direction and encouragement, they also have inherent emotions and moral sensibilities that change with age and maturity, and these need to be recognized and respected. Not given the chance can lead to feelings of shame and guilt which can have a detrimental impact on child self confidence and personal initiative. Play is considered an important aspect in developing 'reciprocity', or 'give and take', and an understanding of rules and obligations. The book describes two methods of moral reasoning: values clarification process and cognitive development approach, as means of fostering moral growth.

Holt, John. How Children Learn. (Revised Edition). New York: Dell Publishing Co., Inc., 1983.

A spirited analysis and description of young children's behavior, abilities and learning potential, based entirely from observation of children in their everyday environment. His approach of diary-like accounts, with support by research into developmental and behavioral theories, is his way of denouncing the scientific, clinical methods of theoretical analysis where "tinkerers, dissectors and manipulators only observe artificial behavior, evasion and retreat". It is also a denouncement of the two traditional views of children: the monster to be beaten into submission, and the machines to be programmed into geniuses. It also proves his thesis that children learn naturally and intuitively; that they have an innate need to learn independently, out of curiosity and interest, and a need to

make sense out of themselves and the world. He urges the reader to "Trust them" to learn, by encouraging and providing opportunities to do so, and encourages people to take children more seriously. Aimed at schools and teachers, but intended for anyone interested in children's learning.

Manning, Glen. The Educative Neighborhood: Theory and Principles for Enhancing Children's Experiential Learning. Unpublished Thesis from the University of Manitoba, for the Degree Master of Landscape Architecture. 1990.

An investigation into how children, specifically ages 8-12 learn from their environments, and how the knowledge of this may be used and applied by designers. Based on an understanding of current developmental and psychological theories, the author looks at how children come to know the environment through casual encounters, which he terms "experiential learning" and identifies things that limit or encourage exploration. Design guidelines are developed which stress the importance of diversity to the creation of a stimulating and 'sensuous' neighborhood. These are applied in a case study design for the Windsor community area. The research is intended for environmental designers to make them aware of the need and opportunities for experiential learning, and their role and obligation to enhance the experiences. Excellent Bibliography.

Moore, Robin C. Childhood's Domain: Play & Place in Child Development. London: Croom Helm Ltd., 1986.

A comparative investigation of children, 'middle years' ages 8-13, from three contrasting neighborhoods to see how configuration and content of the urban setting can support or enhance child development potential. Moore, an urban design professional, undertook this research to fill an existing gap in the literature available. His approach was informal and personal, in an attempt to truly see and experience the relationship of children with others, with habitats, and with the environment, by evaluating what they did, where, with what, and with whom. He wanted to know what spaces were the most important and held special meaning to the children studied, and why. Environmental experience was defined as a function of diversity and access which is limited or controlled by a variety of social, cultural, and physical factories. The book begins with an examination of the relationship between play, place, and child development, then articulates the study by compiling Moore's findings according to activities and opportunities afforded by pathways, linear circuits, areas around the house, formalized or designated play spaces, other green spaces, and abandoned spaces. Analyzing the behavioral phenomena reveals opportunities for supporting child development in the physical world, which may then be translated into policy. An important finding was that the traditional playground was one of the least interesting spaces to children. The natural 'wild' areas tended to be the greatest attraction, as they were often the most stimulating.

Raths, Louis E., Merrill Harmin, Sydney R. Simon. Values and Teaching: Working with Values in the Classroom (2nd Edition). Columbus, Ohio: Charles E. Merrill Publishing Company, 1987.

This book provides an in-depth discussion of the values clarification process, in an attempt to illustrate how a teacher may assist in a child's moral development. It describes 'valuing' as a process comprised of subject matter, personal concern and attitudinal development. The book's focus is on the process of internalizing a value, not on what makes a value good or bad, but how they are acquired. Along with theories and methodologies the book identifies behaviors that signal value difficulties, lists criteria to distinguish values from a belief or attitude (summarized as choosing, prizing and acting) and identifies values indicators.



Seifert, Kelvin. Educational Psychology. Boston: Houghton Mifflin Company. 1983

Applied psychology as it relates to teaching, learning and education, not as a recipe but as guidelines or strategies. Outlines four major fields of educational psychology which are topics essential for effective teaching: development, learning and instruction, motivation, and evaluation, and elaborates on each of these in separate sections. Each section discusses the applicable issues and theories and provides practical examples (case studies) of implications for the individual learner, demonstrating that the ultimate concern should lie with the implications for education and individual growth. Comprehensive, concise, well organized, and understandable.

### Children's Museum - Experiential/Interactive Learning Environments

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Ambach, Gordon M. "Museums as places of Learning", Museum News. December 1986, pp. 35-41.

An education administrator's promotion of the museums' role in public education. He sees the parallel efforts by schools and museums to strengthen and reform, as an opportunity to establish an educational partnership. The article goes on to explain the elements that make for successful school-museum collaborative, elaborating on the positive aspects of Children's museums as substantive learning environments, which embody principles promoting lifelong learning.

Children's Environments Quarterly, Special Edition Issue on Children's Museums.  
Vol. 4, No. 1 (Spring) 1987.

The whole journal is dedicated to the topic of Children's museums and Discovery Centres. It begins with a historic overview of the development and growth of Children's Museums in the United States, tracing the shift from collecting museums to ones with an education emphasis. The compiled articles provide insight into the philosophies, planning and design processes, and technical feats of specific museums and exhibits, and addresses some of the behavioral, psychological issues pertaining to their specialized environments. The following four papers are specifically applicable to this practicum.

- Brown, David. "Outside-In Children's Nature Museum : A Sensory Discovery Room", pp. 36-40.

Outlines the concept and design of the "Outside-In" exhibit, at the Academy of Natural Sciences in Philadelphia; a sensory exhibit which focuses on discovery using senses instead of acquiring factual trivia. Of interest was their approach and attitude to an artificial 'natural' discovery exhibit, designed to "whet appetites to explore by bringing a bit of nature indoors". As a sensory exploratorium first, they felt that a man-made environment, providing adequate stimuli, was as effective as a natural environment, to pre-schoolers. Their efforts to provide comfortable sensory experiences, in hopes of providing a richer learning environment seem commendable.

- Cohen, Uriel. "Learning from Children's Museums: Implications for Design", pp. 16-23.

Outlines three of fourteen critical design principles for interpretive environments: a) the interactive core, b) the visible backstage, and c) a preview. Looks at the issues, qualities and characteristics of each objective in order to demonstrate the implications that child related issues have on design. Through examples, the article shows that these design responses may be embodied in various ways, by either physical or organizational constructs. The author also suggests that child-centered approaches are applicable to many environments and usable by most ages.

- Gallagher, Jeanette McCarthy, & Linda Snow Dockser. "Parent-Child Interaction in a Museum for Preschool Children", pp. 41-45.

The article describes a research methodology which looks at the parent-child interactions in a Children's museum, specifically focusing on who initiates an activity as a measure of interaction patterns, conducted at the Please Touch Museum in Philadelphia. Of particular interest was the discussion of familiarity versus novelty as it relates to distinctions between play and exploration. Too much gadgetry can be overwhelming so it was suggested that a balance of familiar activities be incorporated into all exhibits. For preschool exhibits they suggested using familiar objects near entrances to novel exhibits.

- Hansen, Signe. "Learning in Mixed Crowds: Challenges for Designers of Children's Museum Exhibits", pp. 10-15.

While describing the details of the Boston Children's Museum the article outlines many of the challenges facing designers with such an ambitious mandate and how they were resolved. Exhibit layout and proximity issues of different activities were addressed and the notion of "visceral" learning - where participants identify with the experience of others - was introduced. Indicates that emotionally charged subject matter creates a powerful context for learning.

Cohen, Stewart. "Fostering Shared Learning Among Children and Adults: The Children's Museum". Young Children. May 1989, pp. 20-24.

Introduces the idea of children's museums as institutions for intergenerational, non-instructional learning. The article assumes a universal acceptance of children's museums as positive places for child development and instead focuses on their impact on adult learning. The difference between 'adult' museums and children's museums is primarily seen as a difference in instructional style. Children's museums that emphasize child-adult inquiries provide opportunities of experimenting with previously acquired knowledge in novel ways which "promote concrete over abstract learning, physical over verbal interactions, experiential over conceptual understanding, and sensory over theoretical constructs." (22) The result is an important multi-dimensional learning experience. Good bibliography for resources on 'partnership learning'.

Cohen, Uriel & Ruth McMurtry. Children and Museums: A Design Guide. Milwaukee, Wisconsin: Center for Architecture and Urban Planning Research, University of Wisconsin - Milwaukee, 1985. (Obtained through Inter-library Loan)

Intended for anyone involved in the planning, design and operation of museums for all people, but focused on museums with the spirit of a children's museum. Applied research in response to the lack of empirical information of users of children's museum with respect to design, and the resultant lack of design guidance/process. Key design principles generated which synthesized exploration and analysis into general design directives or guidelines. \*behaviorally based design principles

Fleisher, Barbara. Children's Museums, Zoos and Discovery Rooms, An International Reference Guide New York: Greenwood Press, 1987.

A Directory to Children's museums and Discovery Centers of the world. Sorted by continent, country, and city, it alphabetically lists each center, complete with their mailing address. Each includes about a one page description which outlines the center's history, explains the key exhibits and in the process reveals the goals and objectives, and the intended audience.

Hayward, Jeff. "Exhibit Environments Enhance Educational Effectiveness" in Journal of Museum Education. Vol. 17, No. 3, Fall 1992. pp. 15-16.

Promotes the idea that over and above the content, exhibits can be effective as an environment in and of itself - the genius loci of exhibit design. Deals with the context of the exhibit; the combination of physical space and displays, ambiance, and activity, guided by the notion that when one experiences the environment or 'space' as a stimulating and enriching whole the educational experience is enhanced. He compares this with the "book on the wall" type of display that does nothing to draw you in, urging that environments should be more than a physical context but a physical-socio-sensory context. The article touches on how this impacts the differing types of visitor's experience.

Merriell, Andy. "Love at First Sight". Journal of Museum Education. Vol. 17, No. 3 Fall 1992. pp. 10-12.

An exhibit designer's (i.e. non-educator's) reflection of the relationship between facilitating learning and exhibit design, raising the question "is the exhibit the teacher or the teaching tool?" The article discusses the exhibit's strengths and weaknesses as an educational medium, and questions what is to be used as a basis for determining success/ failure. The author stresses that education is not confined to amassing facts and figures, but is part of the profoundly valuable, memorable experience that comes through interaction and dialogue with others.

Miles, R.S., M.B Alt, D.C. Gosling, B.N. Lewis & A.F. Tout. The Design of Educational Exhibits. London: George Allen & Unwin (Publishers) Ltd., 1982.

A compilation of research and previously undocumented information gleaned from curators and exhibit experts. Provides practical advice about the exhibit planning process from the germ of an idea through to production and evaluation of the finished exhibit. Without belaboring many of the technical considerations, the authors establish guidelines and a methodology for action, pointing out potential problems to avoid and issues to be addressed along the way. In describing effective ways of organizing the intellectual content of an exhibition, through layout and medium, the importance of not going over the heads of the observer is continually stressed.

Pitman-Gelles, Bonnie. Museums, Magic & Children: Youth Education in Museums. Washington, D.C.: The Association of Science-Technology Centers. 1981

A comprehensive resource book about interactive public education centers and programs for youth - children's museums, science centers, natural history and art museums. Though intended for anyone, this is particularly geared toward individuals interested in establishing such a facility. The first section describes methods for developing and running participatory exhibits and programs and illustrates the types of experiences encountered within a variety of exhibit formats. The perception that youth museums must expand their educational roles leads to extensive discussion of the potential enrichment to learning that can be derived through cooperation between school curriculum and community service. A whole section is dedicated to describing over 200 existing children's programs, identifying the facility's address and phone number and the intended user group. The last section is an extensive, well-organized collection of resources and references. Note: Was surprised by the very limited (almost non existent) reference to outdoor exhibits and programs. Most nature, ecology or environmental exhibits identified in this collection were housed inside.

Raven, Peter. "Platforms for Ideas: Museums Must Begin Using Their Unique Educational Forum to Enlighten the Public About Global Conditions", Museum News, November/December 1989, pp. 58-61.

The author expresses his belief that it is the museums' ethic and moral obligation to address the environmental problems. Realizing that the crisis is not a fleeting phase or short term problem, the challenge for museum staff is in determining what they can do to have a positive impact and improve conditions that future generations might face. He suggests ways that the social and environmental problems may be incorporated into exhibits of every type of museum: Fine art, Natural history, Science Centres, etc. The first step is to explain the global predicament. Second, is to promote notions of cultural diversity and ethnic plurality in hopes of breaking down the selfishness that builds barriers. He describes this as a transformation of museums, from "temples of objects to forums for discussion".

Shaman, Sanford Sivitz. "Planning for 'the Responsible Stimulation of Ideas and Opinions,'" The International Journal of Museum Management and Curatorship. 6, 1987, pp. 271 - 276.

Argues the need for museums to consider socially responsible long term strategies as they contribute to an improved and safer world. Exhibits often provide enticing interpretations and an aesthetic display but avoid the ethic issues associated - too often agendas are shaped by those who provide the financial backing. The author decries the notion that exhibits should be understated and neutral. They are powerful, sponsored by institutions with perceived authority, and therefore cannot avoid assuming a point of view. Since presently there are no models for how to address planning for responsible stimulation, only dispersed programs that address societal concerns, the last part of the article suggests steps to realizing socially responsive long range plans which consider the best interest of the public.

### Sustainable Development - in search of a Definition

Cayley, David. The Age of Ecology. Toronto: James Lorimer & Co., Publishers, 1991.

A collection of edited transcripts from five series of the "Ideas" programs broadcast on CBC radio between 1986 and 1990, dealing with contradictory tendencies within environment thought. As a collection they bring to light the disparity between perceived environmental problems and the simplistic single minded solutions proposed. Cayley feels this has resulted from not addressing issues from all perspectives: social, economic and ecological, which only serves to perpetuate these problems. The book has a predominantly philosophical slant as it addresses topics of environmentalism, environmental degradation, environmental thought and the reality of sustainable development. Interviewees include, theorists, journalists, philosophers, conservationists, economists, activists, scientists, and a cultural historian. As Cayley indicates, these programs did not consciously set out to define sustainability but they are tied by a common thread of trying to determine what is 'good'. (which I would further elaborate as being 'good for the long-term future of this planet and its inhabitants'). Written to reflect interview dialogue - back and forth between speakers.

Gordon, David. (ed) Green Cities: Ecologically Sound Approaches to Urban Space. Montreal: Black Rose Books Ltd., 1990..

Green Cities represents a movement that has grown from the realization that cities are our greatest threat to survival - they consume copious amounts of energy and produce even more waste. Since escaping to the countryside is not the solution, 'green cities' insists that we face the fact that cities are anti-nature and look to ecologize them. The authors come from varied professions and perspectives presenting papers which discuss theory, methodologies and initiatives; organic farming, green ways, and innovative waste treatments being just some of the examples which link urbanism and nature.

Hough, Michael. City Form & Natural Process: Towards a New Urban Vernacular. Toronto: Routledge, 1989.

Identifies an urgent need for new urban design values that are environmentally and ecologically responsive. Relates today's problems with man's perception of nature and definition of beauty as characterized by the horticultural tradition of high input, pedigree, monocultures. The text establishes a philosophical basis and provides practical applications for allowing nature to establish, or reestablish itself, on its own or with the help of managed succession, in cities (the combination of fortuitous and vernacular landscapes). Promotes efforts which encourage increased diversity and makes a case for the beneficial aspects of greenways for air quality and wind reduction, waste water management practices that makes efficient use of the unique 'habitat', land drainage impoundment's that recharge the ground water. The author looks at the city as a whole, a system, therefore the 'urban' context expands beyond the typical reference to built up areas, to include green spaces of the suburbs and fringe areas. The ideas presented are sensible, applicable, and feasible, which begs the question "Why are so few of these ideas being implemented?"

Keating, Michael. Toward a Common Future: A Report on Sustainable Development and its Implications for Canada. Environment Canada Publication. 1989.

Brings the focus of "Our Common Future" closer to home, addressing problems, issues and concerns within the Canadian context. Categorizes the major problems, in relatively general terms, resulting from man's impact on the resource base into sections dealing with changes occurring to the atmosphere, land and vegetation, water and wildlife and the resulting tragedy of chemical pollution. The second half attempts to provide realistic and positive 'beyond panic' recommendations, identifying approaches and initiatives, plans and policy, plus some impediments that will need to be overcome in order to turn things around. It then examines the implication that achieving these initiatives will have on government, business, public interest groups, education, and individual behavior.

Roseland, Mark. Toward Sustainable Communities. Ottawa: National Round Table on the Environment and the Economy, 1992.

Realizing that many of the critical environmental issues are rooted in local day to day problems, this book serves as a resource on determining "What can I do", claiming that "enlightened local decisions will be of local and global benefit"(1). Initial discussion points out the problem of ambiguity that surrounds sustainability and attempts to more clearly define it in terms of application at community or local scale. Written for government officials and concerned citizens, it's ideas and recommendations are straight forward, comprehensive and therefore, seemingly easy to assimilate. Provides planning tools and practical initiatives for dealing with issues of air quality, transportation, land use, energy conservation, waste disposal and recycling, and water supply and disposal.

Suzuki, David. Inventing the Future; Reflections on Science, Technology and Nature. Toronto: Stoddart Publishing Co. Limited, 1991.

Looks at the long term impact that science and technology, via genetic interference and chemical warfare and their many spin offs, have had on the natural environment, including man, animals and their habitat, earth. Proposes ways and means of beginning to fix the problem, with a short section dedicated to education.

Thayer, Robert L, Jr. "The Experience of Sustainable Landscapes" in Landscape Journal Vol. 8, No 2, Fall 1989, pp. 101-110.

Discusses the integration of the sustainability into the philosophy, theory and practice of the landscape profession. It defines sustainable landscapes as: those which tend toward ideal conditions by conserving resources, as well as those which achieve a long-term regenerative capacity. The article then attempts to answer the questions of whether sustainable landscapes can be intentionally designed, and if they must always be labor intensive versus energy or chemical intensive. In the discussion it raises another debate over style and points out that current practices are not representative of environmental stewardship, due primarily to a reluctance by clients deviated from the norm. Current landscape practice is still driven by horticultural, 'cosmetic' notion of aesthetics, and sustainable landscapes would tend to run contrary to that practice. Since perception, and knowledge heighten landscape experience and appreciation, there is a need to create new associations between place and perception which challenge the norms, through intentional design.

World Commission on Environment and Development. Our Common Future. New York: Oxford University Press. 1987.

The book that seems to have popularized the term "sustainable development". It represents an international effort which suggests that a fundamental change in society and our world view is needed in order to steer toward a global agenda for change. Three objectives provide direction: to reexamine the key environmental and development issues, and to formulate realistic proposals for dealing with them; to propose new forms of international cooperation and to raise levels of understanding and commitment to action by individuals, voluntary organizations, businesses, institutes, and governments. The bottom line is that "we must collectively stop using up the earth's ecological capital and begin to live on the interest we can get from the sustainable husbandry of its resources".

### Learning about, with and for the Environment

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Bardwell, Lisa. "Success Stories, Imagery by Example" in Journal of Environmental Education, Vol. , No. , 19 pp. 5-15.

Based on theories of cognitive developmental psychology, the author suggests the importance of 'success' stories over of the typical gloom and doom environment disaster stories. While it is important to acknowledge the gravity and urgency of the environmental problems it is equally important to offer perspectives that help people see the positive rather than the overwhelming inevitabilities, that lead to a sense of helplessness. Being told what to do results in outright resistance. Active involvement depends on a) concern, b) competence, and c) imagery. Stories are considered a way of seeing realities as challenges and of empowerment, providing models of environmental problems and peoples roles in them.

Carson, Rachel. The Sense of Wonder. New York: Harpers & Row, Publishers. 1965.

This author focuses on the importance of instilling a sense of wonder in children. By encouraging and participating in active integration and exploration of the world around, parents and adults play a significant role in facilitating a healthy relationship with nature. Exploring nature with a child entails becoming receptive to what lies around you. It is based on the belief that facts and knowledge are perhaps less important than, curiosity and interest - "it is just as important to feel than to know".

Carson, Sean McB. editor. Environmental Education; Principles and Practice. Edward Arnold (Publishers) Ltd., 1978.

Predominantly theoretical, with one chapter that begins to address curriculum development, this book offers instructional ideas promoted by successful practitioners. It begins with a discussion of the major problems of the environmental revolution as evidenced at each of the varied scales of existence: planet, cities and countrysides, and societies. From here it addresses these problems in an environmental education program, looking specifically at the implication and ethical considerations for integrating the concepts into established lecture topics. Understands that to be effective schools must match the program content and direction to the development of the child, and dedicates the last section to describing the developmental requirements, attitudes, motivation, and growing powers of children during their time in school.

Disinger, John, F. "Environmental Education for Sustainable Development" in Journal of Environmental Education. Vol. 21, No. 4, Summer 1990, pp. 3-6.

Discusses the momentum of the programs in the States and the describes the assumed role of educational departments in the furtherance of the notion of sustainability. The author identifies seven fundamental goals for restructuring education to nurture a sustainable society. He looks at implicit and explicit educational approaches and teaching materials. While encouraged by initial attempts to introduce the topic into curriculums, he makes clear that the existing impediments of widespread resistance to interdisciplinary approaches and lack of expressed priority, could be detrimental to imparting a significant and comprehensive message.

Gigliotti, Larry M. "Environmental Education: What Went Wrong? What Can be Done?" in Journal of Environmental Education. Vol. 22, No. 1, Fall 1990, pp. 9-12.

While environmental education programs have produced environmentally *aware* citizenry, this knowledge has not yet found its way into attitudes and lifestyles. Two key problems of existing environmental education programs are identified: a) they have created citizens willing to fight against the misdeeds of others, but uncommitted to make sacrifices themselves for the sake of the environment, and b) they have taught people to think that nature is good, and all human impacts are bad. The discussion is summed up by concluding that what really needs changing is the myth that people are separate from the environment.

Greig, Susan, Graham Pike & David Selby. Earth Rights: Education as if People Mattered. London: Co-published by the World Wildlife Fund & Kogan Page Ltd., 1987.

Looks at new and innovative views and approaches to education, aimed at producing proactive, responsible, and aware citizenry. Though applied to formal educational circles, the ideas are transferable to any context. Emphasizes the difference between narrow and broad focus in terms of environmental degradation and urges a shift away from the compartmentalized 'western' view shaped largely by science to one which fosters an understanding and appreciation of whole systems.

Recognizes that in the past we reacted to crisis, but now we must learn to quit fighting against the limits and live with them by becoming proactive. In determining how to instill, excite, prepare and develop concern and understanding, empowerment is identified as a way by which each child may become the subject rather than the object of his/her own history. Simply, it reflects an earth education approach to environmental education which realizes that the medium is the message - and therefore identifies some environmentally focused subject-based approaches. Excellent, stimulating and motivating text which identifies a number of valuable resources and processes.

Hart, E. P. "Identification of Key Characteristics of Environmental Education" in Journal of Environmental Education. Vol. 15, No. 1, Fall 1981, pp. 12-16.

This article outlines the research process used to derive a list of key concepts that have come to characterized Environmental Education programs and materials. The study was conducted to establish an organization framework for greater understanding and comprehension of the programs purpose and direction, and to act as a basis for change. Of particular interest is the list of twenty five key elements and their one line descriptors which summarizes the current theory and practice of environmental education. The research process provides some insight into the emphasis placed on each of these characters in existing programs and provides a basis for determining some of the gaps and weaknesses within existing environmental education programs.

Johns, F. A., Kurt Allen Liske & A. L. Evans, Education Goes Out Doors. Don Mills, Ontario: Addison - Wesley Publishing Company, Inc., 1986.

Written to encourage teachers to make outdoor experiences an integral part of the curriculum not a frill. Gives examples of how various activities can be incorporated into the regular school schedule, so that the predictable school environment breaks the barrier that traditionally hinder this inquiry based learning process. Appreciates that first hand experiences and learning-by-doing can take place anywhere, but that the more varied interactions found outdoors provide a richer quality of experience. An aid to teachers for planning outdoor experiences.

McInnis, Noel. "You are an Environment: Teaching Learning Environmental Attitudes". Evanston, Illinois: The Center for Curriculum Design.

A book dealing with the teaching and learning of environmental attitudes holistically, by instilling a sense of oneness - a connection - with the environment. The more we value ourselves the more we value the environment. It talks about being 'possible' or 'impossible' (which is equated to survival versus extinction) suggesting that mans ability to make changes in the environment carries with it the constant threat of making the environment impossible to live in, to the point that man's survival becomes impossible. In essence you don't learn *about* it; you live it, and consequently, it is not something to be taught, but a way of teaching. While other environmental education books discuss similar topics, this one offers a unique perspective. I attribute it to the fact that, while most other environmental education programs look at integrating or applying ideas about the environment and ecology into existing educational mandates, McInnis looks at integrating education into the everyday world of the person and the environment.

Robinson, Barbara & Evelyn Wolfson. Environmental Education: A Manual for Elementary Educators. New York: Teachers College, Columbia University. 1982.

A guide for introducing concepts of ecology and the natural environment into the school curriculum. It identifies field activities, lessons, games and workshops, each with a specific theme and purpose, but with an overall goal of learning through participation in the immediate outdoor environment.



Tanner, R. Thomas. Ecology, Environment, and Education. Lincoln, Nebraska: Professional Education Publications, Inc., 1974.

A concise, informative source that looks at the issues, scope and definition of environmental education. The author's hails environmental education as a way of life; a human right more akin to notions of democracy and patriotism. The book discusses the comparative issues of content versus methodology, sequencing, immediate versus global emphasis, positive versus negative approaches, and the impact on cognitive and affected domains of the developing child. The AEP program discussed at the end identifies four basic concepts of environmental education: diversity, adaptation, interrelationship, and change.

### **Environment Programs in Museums and Discovery Centers**

Crosbie, M.J. "The Making of a 'Magical Place'." Architecture. October 1985, pp. 55-61.

Describes the Tree House, an indoor exhibit at the Philadelphia Zoo, designed as a setting to evoke a sense of awe and respect for nature. It is a wonderfully creative and exciting space for children and adults alike, comprised of six distinct 'natural' environments: a swamp, a milkweed meadow, a beaver pond, a honeycomb, a ficus tree and an everglade, each one enlarged and animated so that a child could imagine him/herself as the creature which would inhabit the space. Based on the notion that our understanding of the world is shaped by our sensory experience of it, the exhibit is intended to create contexts in which one's imagination can 'take off', while increasing comprehension, by encourage kids to explore the sensory qualities of each environment. Since the sensory experience is more than just visual, the designers enriched the experiences by incorporating specially placed tactile surfaces, sounds and smells. The remainder of the article explains the collaborative design and development process and details some of the technical difficulties that were overcome.

Dietsch, Deborah K. "Learning From Mother Nature." Architectural Record. September 1985, pp. 120-125.

This article also describes the Tree House, fully titled the George D. Widener Memorial Tree house for the Children's Zoo, Philadelphia. It expands on some of the ideas expressed in the previous article and describes the exhibit much more colorfully as a walk-in diorama, with an 'Alice in Wonderland sense of fantasy'. It was intentionally design with a make believe atmosphere; only an illusion of outdoors.

Fowles, John. "Museums and Science Centres: Collaboration in our Environment" in Muse, Winter 1991, pp. 21-23.

With increasing public emphasis on the state of the environment, the museum is recognized for its valuable supporting role in the public education arena. Particularly science centres, which are more concerned with principles and processes than the more historical slant of museums, find themselves in a unique and powerful position to suggest remedial actions. This article explains the importance of the message and how it is portrayed, touching on the impact that location and juxtaposition of exhibits can have on the message that is picked up (i.e. isolation from the rest of the exhibits versus integration into museum context). An image is included of the "Tower of Trash" exhibit at the Ontario Science Center, which demonstrates the effectiveness of a 'simple' design in making a very clear statement. More importantly the museum must endeavor to set an example by its own actions; to show evidence of practicing what they preach (promoting recycling, avoiding use of CFC products, utilize renewable energy sources). The author reminds us of the delicate nature of the subject matter, particularly since it means attacking the "eco-villains", who are often key sponsors.

## Education Programs and Initiatives for Sustainable Development

Environmental Education Advisory Committee to the Environment Council of Alberta. EE2000: Environmental Education for a Sustainable Future. Alberta: Environment Council of Alberta. 1989.

Examines the role of Environmental Education in helping society achieve sustainable resource use. The paper is geared toward educators, legislators, administrators, and ordinary lay people. Its goal is to help people acquire practical information, and promote an environmental ethic to guide the search for sustainable solutions. The authors feel that environmental education is more than just learning about nature and ecology, it is also about "learning and practicing the conservation ethic needed to ensure that nature as we know it survives"(18). The report discusses the need for EE programs in both informal and formal (schools) settings and recommends strategies and tools to overcome some of the limitations that hinder development of a comprehensive system at present.

Jinkling, Bob. "Why I don't want my Children to be Educated for Sustainable Development" in Journal of Environmental Education. Vol. 23, No. 4, Summer 1992.

Expresses the authors feeling that if you don't know what it is, how can you teach it? He is concerned about the lack of philosophical analysis in discussions to date and claims that sustainability is being imbedded with the same limiting factors that weaken the Environmental Education programs. He also feels that it is not the job of educators to 'train' people to be a certain way and that to prescribe a particular view runs contrary to education's drive for autonomous thinking. He does agree that children should learn about the concepts in order that they be able to make informed judgments of its merit and limitations, but stresses that being educated *for*, is not what education strives for.

Manitoba Education & Training. Sustainable Development Resource Package for grades 5-8; Social Studies & Science Teachers (Manitoba) -DRAFT COPY

A fairly dry manual intended for teachers, curriculum developers, and education administration, that outlines the Department of Education's position and initial strategy for incorporating Sustainable development into the curriculum. The second part suggests unit topics and provides an outline identifying areas where the notion of sustainability may be introduced into the Science and Social studies curriculum and eventually incorporated into all courses and grades. Once internalized the concept is to become a way of teaching and this sort of topical outline will no longer be necessary. The third provides detailed curriculum topics, activities, and strategies. Their main objective is to help students discriminate between "more" sustainable activities and those that are "less" sustainable.

UNESCO. Reshaping Education: Towards Sustainable Development. The United Nations Educational, Scientific and Cultural Organization, 1992.

Addresses education and training as factors for increasing creativity, rationality, problem solving capabilities and competitiveness; characteristics needed to tackle the increasingly complex cultural, social and technological decisions that society faces. It recognizes that the development of a sustainable future is dependent on compromises negotiated by active, knowledgeable citizens and decision makers. Education is viewed in the broadest sense, with an emphasis on targeting the big businessmen governments and policy makers, those who may have an immediate and far reaching impact on the state of our environment; recognizing that education is more than a social issue but also a matter of economic policy. The article provides a comparison between traditional education and education for sustainable development, comparing and contrasting such issues as: links with society, institutional strategies, contents, and methodological approaches, and expected outcomes.

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# *B I B L I O G R A P H Y*

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