toronto zoo

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Chair
Councillor Paul Ainslie

Interim Chief Executive Officer
Robin D. Hale

2018-04-03

REQUEST FOR PROPOSAL
SITE SERVICES STUDY
RFP # 12 (2018-03)

You are invited to submit a written proposal to provide professional consulting services to carry out a site services study at the Toronto Zoo. Services to include review of existing facility and services, testing, review of drawings and reports, and interview with key Zoo staff. Assessment of the water, natural gas, high voltage, sanitary, and storm sewer, emergency phone system, and communication distribution systems. A detailed interim and final report on the existing condition of all site services, complete with a multi-year maintenance and refurbishment plan, will be required.

Site Inspection: A project site inspection for consultants will be held **Wednesday, 2018-04-04, at 0900 hours (9:00a.m.)**. Meet at the Administrative Support Centre, enter at Gate A, 361A Old Finch Avenue, west of Meadowvale Road, Toronto, Ontario, M1B 5K7.

Proposal: Provide **four (4)** copies of your proposal**, one (1)** unbound signed and clearly marked as ORIGINAL and **three (3**) copies of the original proposal clearly marked as COPY and **one (1)** electronic copy (Microsoft Word or PDF) on a CD or flash drive in a sealed package or envelope. The original and all copies should be identical (excluding any obvious differences in labeling as noted above). Proposal to be delivered to the office of Purchasing & Supply, Toronto Zoo, Administrative Support Centre, 361A Old Finch Ave., Toronto, Ontario, M1B 5K7 by:

Due Date: **Thursday, 2018-04-19, by 1200 hours (noon), local time**

Proposals shall remain in effect for a period of ninety (90) days from the Proposal due date.

The Board of Management of the Toronto Zoo reserves the right to reject any or all Proposals or to accept any Proposal, should it deem such action to be in its interests.

If you have any queries regarding this request for proposal, please contact Mr. Peter Vasilopoulos, Supervisor of Purchasing & Supply at 416-392-5916 or pvasilopoulos@torontozoo.ca. If you require further technical details, please contact Ben Knoop, Project Manager at 416-392-6002 or bknoop@torontozoo.ca.

Yours truly,

Taryne Haight
Interim Manager, Financial Services

PROPOSAL CONTENTS

1.0 GENERAL TERMS

1.1 The following definitions will apply to this Request for Proposal and to any subsequent Contract:

1.1.1 "**Board**" means the Board of Management of the Toronto Zoo;

1.1.2 **"COO"** means the Chief Operating Officer or designate of the Toronto Zoo;

1.1.3 "**Consultant**" means the person, partnership or corporation contracting with the Board to provide the required Services;

1.1.4 "**Contract**" means acceptance by the Toronto Zoo (by way of written acknowledgement, Agreement, Contract or Purchase Order) to furnish Services for money or other considerations;

1.1.5 "**Contract Price**" means the price payable under the contract to the Consultant, being the Proposal Price eventually accepted by the Board of Management of the Toronto Zoo subject to any changes pursuant to the Contract Requirements;

1.1.6 **"Proponent"** means an individual or company that submits or intends to submit, a proposal in response to this Request for Proposal;

1.1.7 "**Proposal Price**", "Contract" and "Contract Documents" have the meanings set out therefore in clauses contained in these documents;

1.1.8 **Request for Proposal (RFP)"** means the RFP document in its entirety, inclusive of any addenda that may be issued by the Toronto Zoo;

1.1.9 "**Services" or "Work**" means everything that is necessary to be performed, furnished delivered by the Consultant to meet the Consultant's obligation under this Contract;

2.0 DESCRIPTION AND SCOPE OF PROJECT

2.1 The site services study shall be completed in 2018. The scope of work includes the following:

2.1.1 In general, the scope of work consists of a comprehensive site services assessment and Condition Survey of the water, gas, electrical and communication/data services, emergency phone system, and storm/sanitary sewer systems on the site to determine the existing condition, deficiencies, and timelines for repair/replacement. The study will be broken down into 2 phases:

a) Phase I; Services Audit
b) Phase II; Development of Life Cycle Repair/Replacement and Maintenance Plan & Report

2.2 The objectives of the assessment will be to:

2.2.1 Identify deteriorated elements that should be rehabilitated or replaced.
2.2.2 Assess the systems' ability to meet current demand requirements based on actual demand and industry recognized design criteria.
2.2.3 Identification of reserve capacity.
2.2.4 Estimate scope of upgrades, repairs or replacement likely to be required, to meet current or identified future requirements (Toronto Zoo Capital Master Plan), and codes and legislations. Identify timelines for each recommendation.
2.2.5 Estimate timing and cost of repairs, upgrades or replacement identified.
2.2.6 Indicate approvals needed, if any, to proceed with contemplated work.
2.2.7 Develop an understanding of the future needs of the Zoo complex so that the Zoo can predict the funding necessary to maintain the services in an appropriate condition after the reduction or elimination of the current required repairs liability.
2.2.8 Locate all existing services using GIS and provide a drawing of all located services to the Toronto Zoo in .dwg format. Location data to be provided for service runs, valves, catch basins, manholes, and hand wells.
2.2.9 Create a report outlining the findings of the study. The Zoo will load this data into Asset Management Software which will continue to provide an accurate record of the state of the physical plant. The system will be used to predict the funding required to maintain desired conditions and will foster the creation of multi-year comprehensive capital implementation plans. Report is to be in an excel file, and in a format which can be easily imported into the Zoo's software.

2.3 The Consultant will be required to:

2.3.1 Examine existing drawings, reports and verify by site visit and discussion with Zoo staff.
2.3.2 Review the latest edition of all relevant guidelines and standards including, but not limited to the Occupational Health & Safety Act, Ontario Building Code, National Building Code, City of Toronto Green Roofs Strategy and the Toronto Green Development Standards.
2.3.3 Consultant to contact utility service providers (Toronto Hydro, Toronto Public Utilities, and Enbridge Gas) to obtain their input and any relevant information related to the systems as is required to undertake and fulfill the requirements of the study.
2.3.4 Provide detailed and summary recommendations related to the need for repair or upgrade and anticipated cost implications.

2.4 Consultants will conduct interviews with key Zoo resource staff to gain an understanding of users service requirements and current facility related matters.

2.5 The Consultant Team proposals must include examples of this expertise and successful completion of similar projects in scale and content.

2.6 It is anticipated that the successful firm will have at least the following disciplines in order to undertake this project: architectural, mechanical engineering, and electrical engineering.

2.7 Water Distribution System

2.7.1 Review the size, capacity, and pressure of the water distribution system at the Zoo.
2.7.2 Review all records of actual usage.
2.7.3 Undertake inspection and testing (as required) to determine the condition of the water distribution system.
2.7.4 Assess the adequacy of the existing system to meet current demand requirements including hydrant and sprinkler system needs.
2.7.5 Review the size and capacity of the existing service and its ability to accommodate future building additions/expansions, equipment changes, and/or additional demand requirements.

2.8 Gas Services

2.8.1 Review the size and capacity of the Natural Gas delivery system at the Zoo.
2.8.2 Review all records of actual usage including peak demand times.
2.8.3 Review gas appliance inventory and design demand requirements.
2.8.4 Undertake inspection and testing (as required) to determine the condition of the gas distribution system.
2.8.5 Assess the adequacy of the existing gas service to meet the demand requirements of the Zoo based upon:
a) Actual (Historical) usage
b) Design demand
2.8.6 Review the size and capacity of the existing service and its ability to accommodate building expansions, equipment changes and/or additional buildings.

2.9 Hydro Service

2.9.1 Review the existing high voltage distribution systems at the Zoo.
2.9.2 Review maintenance reports and records regarding the high voltage equipment.
2.9.3 Undertake inspection and testing, as required, to determine the condition of the buried high voltage distribution lines.
2.9.4 Assess the adequacy of the existing system to meet current and future demand requirements.

2.10 Sanitary and Storm Sewer

2.10.1 Review the size and capacity of the sanitary and storm distribution systems at the Zoo.
2.10.2 Undertake inspection and testing (as required) to determine the conditions of the underground piping.
2.10.3 Assess the adequacy of the existing systems to meet current demand requirements.
2.10.4 Review the size and capacity of the existing systems to accommodate building expansions, and/or additional buildings.

2.11 Communications System

2.11.1 Review the existing internal telephone distribution system at the Zoo.

2.11.2 Undertake inspection and testing (as required) to determine the condition of the communications system.
2.11.3 Assess the adequacy of the existing system to meet current and future requirements.

2.12 Emergency Phone System

2.12.1 Review the existing internal emergency (red) telephone system at the Zoo.
2.12.2 Undertake inspection and testing (as required) to determine the condition of the emergency phone system.
2.12.3 Assess the adequacy of the existing system to meet current and future requirements.

2.13 Assessment Recommendations

2.13.1 Report to review and evaluate the condition and capacity of each of the systems to meet current demands.
2.13.2 Report to review and evaluate the capacity of each of the systems to meet future requirements.
2.13.3 Report to identify the existing condition and the scope of repairs or upgrades which are likely to be required to meet items 2.13.1 and/or 2.13.2 above.
2.13.4 Report to identify budget estimates to carry out repairs, refurbishments or upgrades for each system.
2.13.5 Report to identify timeline for repairs/replacements identified.

2.14 Upon award of the contract, the selected Consultant will enter into an agreement for consulting services with the Zoo by purchase order or contract incorporating the terms and conditions of the Request for Proposal and the Proponent proposal, as determined by the Zoo. **The Sample Agreement is attached (Appendix II).**

2.15 Upon successful selection of consultant, design work is expected to be undertaken immediately and proceed as fast as possible in order to meet the completion dates identified in Section 8.

3.0 CONSULTANT SERVICES DELIVERABLES TO BE PROVIDED

Objectives
In general the objectives of the proposed project are the following:

- Provide an assessment of the existing deferred maintenance and deficiencies. For every deficiency identified in the survey report, devise one or more method of correction.
- For every correction project a preliminary budget, a prioritized schedule for the work and an estimate budget using the RSMeans data indexed for Toronto or equivalents in 2018 $'s.
- Rank and Prioritize all deficient conditions, associated correction projects and information concerning systems and deficiency.
- Provide digital photograph documentation of individual items and each identified deficiency that is linked to the system.
- Locate each recommendation, locate the item using GIS.
- Establish a component depreciation analysis to forecast renewal investment rates required to maintain facilities over time.

3.1 Deficiency Priorities: Each correction project identified in the field audit shall be prioritized in the following manner:

3.1.1 Priority 1 Currently Critical (Immediate)
Conditions in this category require immediate action to:

a. correct a cited safety hazard
b. stop accelerated deterioration
c. return a system to operation

3.1.2 Priority 2 Potentially Critical (Year One)
Conditions in this category, if not corrected expeditiously, will become critical within a year. Situations within this category include:

a. intermittent operations
b. rapid deterioration
c. potential life safety hazards

3.1.3 Priority 3 Necessary – Not Yet Critical (Years 2 –5)
Conditions in this category require appropriate attention to preclude predictable deterioration or potential downtime and the associated damage or higher costs if deferred further.

3.1.4 Priority 4 Recommended (Year 6-10)
Conditions in this category include items that represent a sensible improvement to existing conditions. These are not required for the most basic function of the system; however, Priority 4 projects will improve overall usability and/or reduce long-term maintenance costs.

3.1.5 Priority 5 Does Not Meet Current Codes/Standards – "Grandfathered"
Conditions in this category include items that do not conform to existing codes, but are "grandfathered" in their condition. No action is required at this time, but should substantial work be undertaken in contiguous areas, certain existing conditions may require correction.

3.2 Deficiency Categories: Each correction project identified shall be assigned one of the following categories:

- Life-safety Code Compliance
- Building Code Compliance
- System Integrity
- Functionality
- Energy
- Environmental:
  - ACBM (asbestos containing building materials)
  - PCBs
  - Lead-based paints
  - CFCs
  - Water Quality

3.3 Proposed Recommendations

3.3.1 Report to review and evaluate the conditions of all major components.
3.3.2 Report to include budget estimates on the basis of expected repair or replacement costs and life expectancies of the common elements.

3.3.3 Recommend improvements which are likely to minimize deterioration or increase the life expectancy of existing elements.

3.3.4 Identify those common elements likely to deteriorate and require repair or replacement.

3.3.5 Estimate the scope of repairs or replacement which is likely to be required.

3.3.6 To estimate the times repair phasing when repairs or replacement will be necessary and the life expectancies following the repairs of the existing facility.

3.3.7 Estimate budgets to carry out the repairs or replacement of all the common elements and life expectancies.

3.3.8 Report to include 20 year capital and maintenance plan and preventative measures.

3.4 Administrative

3.4.1 Consultant to attend and take minutes at all Study meetings, other site, facility and program reviews, and special meetings as required throughout the duration of the Study.

3.4.2 Consultant to co-ordinate and liaise with all sub-consultants and others as necessary making sure all relevant issues have been raised and concluded.

3.4.3 Preparation of all planning documents, maps, drawings, and other final products for the Services as necessary.

3.4.4 The Consultant is to work within their cost identified in the bid forms on this RFP and be responsible for all work necessary to ensure conformance to budget, which includes the cost of consultant fees, design and final report documents, disbursements, etc.

3.4.5 Where there is a change to the scope of the Services, the Consultant will provide an estimate of the costs of the changed items for approval prior to undertaking the additional work.

3.4.6 Consultant is responsible for the preparation of detailed interim and then final Assessment of Toronto Zoo site services.

3.4.7 Recommendations to incorporate energy efficiency, sustainability and "Green Technology".

3.4.8 Report to reflect/incorporate Capital/Operating Project plans into report recommendation.

3.4.9 Audit Report to include an Executive Summary complete with a tabular financial summary, and separate detailed sections for each system.

3.4.10 Provide five (5) copies of the report in draft for review and comment by the Toronto Zoo.

3.4.11 Provide five (5) copies of the final report to the Toronto Zoo. One original copy will be in a 3-ring binder, while the other four are to be bound and one (1) electronic copy (Microsoft Word or PDF) on a CD or flash drive.

3.4.12 Direct assistance and liaison of Consultant with Zoo Facilities & Services staff. The Consultant will liaise with Zoo staff throughout the Audit regarding Audit methodology, site access, and to review and finalize the Audit reports and recommendations.

3.4.13 Consultant to prepare an inspection plan and schedule for each location and submit to the Zoo for approval prior to commencing the site investigation work.

4.0 INSURANCE, INDEMNIFICATION AND POLICIES

4.1 Professional liability insurance in the amount of $1,000,000 (per claim) and $5,000,000 general liability insurance in respect of injury or death to a single person or for property damage in a manner satisfactory to the General Manager must be maintained through the Project and included in the Fee Proposal.

4.2 The Consultant hereby agrees that the Consultant will keep harmless and fully indemnify the Board, the City of Toronto, the Toronto and Region Conservation Authority, their employees, officers and agents against all actions and claims against all loss, liability, judgments, costs, demands or expenses which they or any of them may sustain as a result of the negligent or intentional acts or omissions of the Consultant, its agents, servants, employees or sub-consultants or any of them, in the performance of the Services, save and except and only to the extent that any such loss, liability, judgments, costs, demands or expenses are caused by the Board or those for whom at law it is responsible.

4.3 All insurance policies shall be endorsed to provide a minimum advance written notice of not less than thirty (30) days, in the event of cancellation, termination or reduction in coverage or limits, such notice to be made to the Chief Operating Officer.

4.4 The Consultant shall, as applicable, conform to and enforce strict compliance with the Occupational Health and Safety Act and for purposes of the Act be designated as the "constructor" for the Service.

4.5 The Consultant must adhere to all relevant Zoo policies, including, but not limited to, the Contractor Safety Policy, Working in the Vicinity of Animal Containments Policy and the Vehicles on Site Policy, copies of which the Chief Operating Officer, Toronto Zoo, shall supply to the Consultant.

5.0 PROPONENT SUBMISSION REQUIREMENTS

Provide **four (4)** copies of your proposal**, one (1)** unbound signed and clearly marked as ORIGINAL and **three (3**) copies of the original proposal clearly marked as COPY and **one (1)** electronic copy (Microsoft Word or PDF) on a CD or flash drive in a sealed package or envelope. The original and all copies should be identical (excluding any obvious differences in labeling as noted above). Proposal to be delivered to the office of Purchasing & Supply, Toronto Zoo, Administrative Support Centre, 361A Old Finch Ave., Toronto, Ontario, M1B 5K7 by **1200 hours (noon) local time on Thursday, 2018-04-19**.

5.1 Title page showing request for Proposal Proponent's name

5.2 Duly executed proposal form

5.3 Indicate the individual or incorporated name of the Proponent (i.e. the prime Consultant); address(es); telephone and fax number(s); and name of key contact person(s).

5.4 The Proponent must provide names and company information for all Sub-consultants required by Consultant.

5.5 State the scope and limits of responsibility of the Consultant and Sub-consultants named in the team. Retention of all specialized sub-consultants (e.g. architectural engineering, alternative/ green energy, quantity surveyor, etc.) necessary to complete all design stages and construction of the project is the responsibility of the Consultant.

5.6 Provide a schedule or chart of the proposed tasks, hours and the hourly rates for each person associated with this project.

5.7 The Proponent must confirm compliance with the Insurance and Indemnification provisions identified in Section 4.0.

5.8 Clearly indicate how project design and construction will be managed to conform to assigned project budgets, sub-consultants needed, construction timing, etc., if necessary.

5.9 Clearly articulate key personnel to be involved with the project and their responsibilities. Indicate the qualifications and experience (beyond a general resume), that each member will bring to the team and include a breakdown on the number of hours each will devote to the Project and their hourly billing rate. Indicate the total extent of availability of all team members throughout entire project period.

5.10 Provide the name, location, client reference and brief description of not more than five (5) similar projects under the direct responsibility of the persons or team named above.

5.11 Guarantee project start immediately following successful confirmation of award of project, and work to implementation and completion schedule according to schedule of events in section 8.0 within the RFP

6.0 PROPONENT FEE PROPOSAL

6.1 On the Fee Proposal Form (Appendix I), provide an upset fee limit for the Site Services Study, inclusive of disbursements, plus HST broken out for each Project phase, as follows:

- Site Inspection / Assessment
- Interim Report;
- Final Report;
- Disbursement Allowance.
- HST.

All Consultant and Sub-consultants costs for research, surveys, drawings, specifications, models, renderings and photographic and similar costs to be the responsibility of the Consultant, identified and included as part of the fees in the Fee Proposal.

6.2 Provide hourly rates for other services which may be requested during completion of the assessment.

6.3 An upset limit for disbursements is required, including, but not limited to, reproduction, postage, courier, fax machine, long-distance telephone calls; printing of drawings and specifications, photographic production, approved Consultant travel, as required. Photocopies of receipts must be provided for disbursements.

6.4 Soil and topographical surveys, environmental testing, permits and application fees are not to be included in the Fee Proposal and will be reimbursed separately if required and approved in advance. Consultant to arrange these if required, as part of their work for the project.

6.5 A 10% holdback will apply to all fees, not including disbursements, to be released after 45 days following completion of work.

6.6 Proposal prices shall remain in effect for a period of ninety (90) days from the proposal due date of **Thursday, 2018-04-19**.

6.7 The Proponent shall bear all costs and expenses with respect to the preparation and submission of its Proposal and the bidder participation in the proposal process (the "Proposal Costs"), including but not limited to: site visits and inspections, all information gathering processes, interviews, preparing responses to questions or requests for clarification from the Board, preparation of questions for the Board, and contract discussions and negotiations.

6.8 The Zoo shall not be responsible for or liable to pay any Proposal Costs of any bidder regardless of the conduct or outcome of the Proposal Request, Purchase Order, or Contract process.

7.0 PROPOSAL EVALUATION AND SELECTION

7.1 The Proponent is urged to ensure that its Proposal is submitted in the most favourable terms in order to reflect the best possible potential, since less than best potential could result in exclusion of the Proposal from further consideration.

7.2 The Agreement will not be awarded to the Proposal with the lowest cost, but rather, award shall be based on an evaluation of the Consulting team's expertise, prior project experience, proposed methodology, and price. Additionally, the Zoo may accept or reject any part of the Proponent's bid.

7.3 An Evaluation Team comprised of representatives designated by the Zoo will evaluate responses to the RFP.

7.4 There are three steps to the pre-defined evaluation process:

Step 1 – Initial Review of Responses
Step 2 – Evaluation of Submitted Proposals
Step 3 – Evaluation of Presentations

7.5 Step 1 – Initial Review of Responses

The Zoo will open only those Proposals received by the Proposal Deadline and time specified within this RFP. Immediately upon opening, the Zoo will review each Proposal for compliance with the instructions and conditions applicable to this RFP. The Zoo, at its option, may seek Proponent retraction and clarification of any discrepancy/contradiction found during its review of Proposals.

7.6 Step 2 – Evaluation of Submitted Proposals

7.6.1 The Evaluation Team will evaluate each submitted Proposal, that has passed through Step 1, on criteria that will include, but not necessarily be limited to, the following:

Evaluation Criteria	Points
Depth and breadth of the Project team's relevant qualifications and experience with similar scale and type of assessments	25
Depth and breadth of the project team Lead's relevant qualifications and experience	20
Commitment to complete work according to schedule of events in section 8.0 within the RFP	10
Availability of team members during entire site services study	10
Understanding of project scope of work	10
Details on the general approach and methodology that proponent would take in performing the services outlined within the RFP	10
Fee Proposal	15

7.6.2 The Zoo may, at its discretion, eliminate a Proposal from further consideration if it deems the overall cost to be prohibitive.

7.6.3 A short-list of suitable Proponents may be established who may be invited to Step 3 to provide presentations related to their Proposal.

7.7 Step 3 – Evaluation of Presentations (If Required)

7.7.1 Invited Proponent(s) shall provide presentations in support of their Proposals or to demonstrate or otherwise expand on the information contained therein.

7.7.2 The Proponent(s) shall ensure that the presentation is made by well versed staff with the authority to make decisions and commitments on behalf of the Proponent.

7.7.3 Any and all costs incurred by the Proponent in order to prepare for and attend the presentation and/or demonstration including transportation, food, lodging, etc. shall be borne entirely by the Proponent.

7.8 The final score is then calculated as illustrated in the following table:

Evaluation	Score
Step 1 – Initial Review of Submitted Proposals	Prerequisite
Step 2 – Evaluation of Submitted Proposals	Maximum 100
Step 3 – Evaluation of Presentations (If Required)	(Maximum 50 If Required)
Total maximum score excluding Presentation	**100**
Total maximum score including Presentation	**150**

7.9 By responding to this Proposal, the Proponent agrees to accept the recommendation of the Evaluation Team as final.

7.10 All Proposals shall be submitted by the Proponent on the understanding that the Proposals shall become the property of the Zoo.

8.0 SCHEDULE OF EVENTS

The following is a tentative schedule for the Site Services Study process. The final schedule will be developed jointly with the successful proponent in the first week of project execution:

Pre-Award	
Release of RFP	**2018-04-03**
Proponents' Question Deadline	**2018-04-09**
Submission Due	**2018-04-19**
Interviews, if necessary	**Week of 2018-04-23**
Notification of Award By the Toronto Zoo	**2018-04-30**
Post-Award	
Commencement of Work	**2018-05-07**
Interim Report @50% Due	**2018-06-11**
Draft Final Report Due	**2018-06-29**
Final Report Due	**2018-07-13**

The RFP process and project will be governed according to the above schedule or other schedule provided by the Consultant and approved by the COO of the Toronto Zoo. Although every attempt will be made to meet all dates listed, the Toronto Zoo reserves the right to modify any or all dates at its sole discretion. Appropriate notice of change will be provided, in writing, as soon as is feasible so that each Proponent will be given the same non-preferential treatment.

9.0 PROPOSAL TERMS AND PROVISIONS

The successful Proponent shall be retained through a contractual agreement and/or a purchase order, which includes the terms and conditions of this Request for Proposal.

9.1 Consultant's Liability and Indemnity

The Consultant will from time to time at all times hereafter well and truly save, defend and keep harmless and fully indemnify the Board, the City of Toronto, and the Toronto and Region Conservation Authority and each of their officers, employees and agents (hereinafter called the "Toronto Indemnities") of, from and against all manner of action, suits, claims, executions and demands which may be brought against or made upon the Toronto Indemnities or any of them and of, from and against all loss, costs, charges, damages, liens and expenses which may be sustained, incurred or paid by the Toronto Indemnities, their officers, employees and agents or any of them by reason of or on account of or in consequence of the execution of this agreement or provision of the business or any other work or matter to be carried out or performed by the Proponent with respect to the Request for Proposal or any agreement that may result from the request for proposal process, and/or the non-execution or imperfect or improper execution thereof and will pay to the Toronto Indemnities on demand any loss, costs, damages and expenses which may be sustained, incurred or paid by the Toronto Indemnities or any of them in consequence of any such action, suit, claim, lien, execution or demand and any monies paid or payable by the Toronto Indemnities or any of them in settlement or discharge on account thereof.

The Consultant shall be responsible for any and all damages, or claims for damages for injuries or accidents done or caused by his or her employees, or resulting from the prosecution of the Work, or any of their operations, or caused by reason of the existence of location or condition of the works, or of any materials, plant or machinery used thereon or therein, or which may

happen by reason thereof, or arising from any failure, neglect or omission on their part, or on the part of any of their employees to do or perform any or all of the several acts or things required to be done by him or them under and by these General Conditions, and covenants and agrees to hold the Board, the Toronto and Region Conservation Authority and the City of Toronto, their officers, agents, employees, Consultants and invitees harmless and indemnified

for all such damages and claims for damage; and in case of the Consultant's failure, neglect or omission to observe and perform faithfully and strictly, all the provisions of the Work, the COO may, either with or without notice (except where in these Contract Requirements, notice is specially provided for, and then upon giving the notice therein provided for), take such steps, procure such material, plant trucks and men, and do such work or things as he/she may deem advisable toward carrying out and enforcing the same and any such action by the COO as he is herein empowered to take, shall not in any way relieve the Consultant or his/her surety from any liability under the Contract.

9.2 **Incurred costs**

The Proponent shall bear all costs and expenses with respect to the preparation and submission of its Proposal and the Proponent's participation in the proposal process (the "Proposal Costs"), including but not limited to: all information gathering processes, interviews, preparing responses to questions or requests for clarification from the Board and contract discussions and negotiations.

The Toronto Zoo shall not be responsible for or liable to pay any Proposal Costs of any Proponent regardless of the conduct or outcome of the Proposal Request, Purchase Order process, or Contract process.

9.3 The RFP does not constitute an offer or tender by the Toronto Zoo. Receipt of Proposals by the Toronto Zoo pursuant to this RFP or selection or notification confers no rights under any Proposal nor obligates the Toronto Zoo in any manner whatsoever.

9.4 **Liability of Errors**

While the Toronto Zoo has used considerable efforts to ensure an accurate representation of information in this Request for Proposal, the information contained in this Request for Proposal is supplied solely as a guideline for Proponents. The information is not guaranteed or warranted to be accurate by the Toronto Zoo, nor is it necessarily comprehensive or exhaustive. Nothing in this Request for Proposal is intended to relieve Proponents from forming their own opinions and conclusions with respect to the matters addressed in this Request for Proposal.

9.5 **Toronto Zoo Rights and Options Reserved:**

The Toronto Zoo reserves the right to award the contract to any proponent who will best serve the interest of the Toronto Zoo. The Toronto Zoo reserves the right, in its sole discretion, to exercise the following rights and options with respect to the proposal submission, evaluation and selection process under this RFP:

(a) To reject any or all proposals.
(b) To re-issue this RFP at any time prior to award of work.
(c) To cancel this RFP with or without issuing another RFP.
(d) To supplement, amend, substitute or otherwise modify this RFP at any time prior to the selection of one or more proponents for negotiation.

(e) To accept or reject any or all of the items in any proposal and award the work in whole or in part.
(f) To waive any informality, defect, non-responsiveness and/or deviation from this RFP and its requirements.

(g) To permit or reject at the Toronto Zoo's sole discretion, amendments (including information inadvertently omitted), modifications, alterations and/or corrections of proposals by some or all of the proponents following proposal submission.

(h) To request that some or all of the proponents modify proposals based upon the Toronto Zoo's review and evaluation.

(i) To request additional or clarifying information or more detailed information from any Proponent at any time, before or after proposal submission, including information inadvertently omitted by the proponent.

9.6 **Cancellation**

Nothing herein shall be construed as giving the Proponent the right to perform the services contemplated under this agreement beyond the time when such services become unsatisfactory to the Toronto Zoo; and in the event that the Proponent shall be discharged before all the services contemplated hereunder have been completed or the services are for any reason terminated, stopped or discontinued because of the inability of the Proponent to serve under this agreement, the Proponent shall be paid only for the portion of the work which shall have been satisfactorily completed at the time of termination.

9.7 **Ownership and Confidentiality of Board-Provided Data**

All correspondence, documentation and information provided by the Toronto Zoo staff to any bidder or prospective Bidder in connection with, or arising out of this RFP, the services or acceptance of the RFP:

9.7.1 is and shall remain the property of the Board;
9.7.2 must be treated by Proponents and Prospective Proponents as confidential;
9.7.3 must not be used for any purpose other than for replying to this RFP, and for fulfillment of any related subsequent agreement.

9.8 **Copyright:**

The final product and related materials from the work is to be for the exclusive use of the Toronto Zoo. The Toronto Zoo shall be the only and sole owner of the product and related materials for the sole and unfettered use by the Toronto Zoo. Upon payment of the said product and related materials by the Toronto Zoo, the successful bidder shall have no hold, proprietary claim, ownership, use of any kind, intellectual or otherwise nor shall there be any restrictions placed on the final product and related products by the successful bidder. By submitting a Proposal in this response to this RFP, the Bidder shall thereby acknowledges and agrees that the Toronto Zoo has exclusive ownership and sole and unfettered use of this final product and related products.

9.9 **Ownership and Disclosure of Proposal Documentation**

The documentation composing any Proposal submitted in response to this RFP, along with all correspondence, documentation and information provided to the Toronto Zoo by any Bidder in connection with, or arising of this RFP, once received by the Toronto Zoo:

9.9.1 Shall become property of the Toronto Zoo and may be appended to purchase order issued to the successful Bidder;

9.9.2 Shall be come subject to the Municipal *Freedom of Information and Protection of Privacy Act ("MFIPPA") and may be released pursuant to that Act*

Because of *MFIPPA*, prospective Bidders are advised to identify in their Proposal material any scientific, technical, commercial, proprietary or similar confidential information, the disclosure of which could cause them injury.

Each Bidder's name shall be made public. Proposals will be made available to member of the Board on a confidential basis and may be released to members of the public pursuant to *MFIPPA.*

9.10 **Conflict of Interest Statement**

In its Proposal, the Proponent must disclose to the Toronto Zoo any potential conflict of interest that might comprise the performance of the Work. If such a conflict of interest does exist, the Toronto Zoo may, at its discretion, refuse to consider the Proposal.

The Proponent must also disclose whether it is aware of any Toronto Zoo employee, member of board, agency or commission or employee thereof having a financial interest in the Proponent and the nature of that interest. If such an interest exists or arises during the evaluation process or the negotiation of the Agreement, the Toronto Zoo may, at its discretion, refuse to consider the Proposal or withhold the awarding of any agreement to the Proponent until the matter is resolved to the Toronto Zoo's sole satisfaction.

Proponents are cautioned that the acceptance of their Proposal may preclude them from participating as a Proponent in subsequent projects where a conflict of interest may arise. The Consultant(s) for this project may participate in subsequent/other Toronto Zoo projects provided the Consultant(s) has (have) satisfied pre-qualification requirement of the Toronto Zoo, if any and in the opinion of the Toronto Zoo, no conflict of interest would adversely affect the performance and successful completion of an Agreement by the Consultant(s).

If, during the Proposal evaluation process or the negotiation of the Agreement, the Proponent is retained by another client giving rise to potential conflict of interest, then the Proponent will so inform the Toronto Zoo. If the Toronto Zoo requests, then the Proponent will refuse the new assignment or will take steps as are necessary to remove the conflict of interest concerned.

9.11 **No Collusion**

A proponent shall not discuss or communicate, directly or indirectly, with any other Proponent or their agent or representative about the preparation of the Proposals, Each proponent shall attest by virtue of signing the Proposal Submission Form that its participation in the RFP process is conducted without any collusion or fraud. If the Toronto Zoo discovers there has been a breach of this requirement at any time, the Toronto Zoo reserves the right to disqualify the Proposal or terminate any ensuing Agreement.

9.12 **Governing Law**

This RFP and any quotation submitted in response to it and the process contemplated by this RFP including any ensuing Agreement shall be governed by the laws of the Province of

Ontario. Any dispute arising out of this RFP or this RFP process will be determined by a court of competent jurisdiction in the Province of Ontario.

9.13 **Education Institute Status**

The Toronto Zoo is a registered educational institute and accordingly may be eligible for preferred pricing which should be reflected in the Tender as submitted

9.14 **Charity Status**

The Toronto Zoo is a registered charitable organization (registration #BN 119216398RR0001) and accordingly may be eligible for preferred pricing which should be reflected in the Quotation as submitted

10.0 PROPOSAL FORM

The undersigned Proponent having reviewed and fully understood the RFP and all terms and requirements of the RFP and all terms and conditions of the RFP and information provided, hereby submits the attached Proposal and supporting materials ("the Proposal") in accordance.

I/We, hereby, have received, allowed for and included as part of our submission all issued Addendum numbered _____.

The Board of Management of the Toronto Zoo reserves the right to reject any or all Proposals or to accept any Proposal, should it deem such action to be in its interests.

By submitting a Proposal the Proponent agrees to all of the terms and conditions of this Request for Proposal.

By signing and submitting this proposal, you are agreeing to the release of your proposal information, as deemed necessary by the Board, in order to conduct business associated with this proposal or project.

COMPANY INFORMATION	
Company Name:	
Name of authorized Signing Officer	Title:
Signature:	Date:
Contact Name:	Title:
Address:	
Telephone #:	Fax #:
Email:	Web Site:
HST #:	

DISCOUNT	**Discount**	**Days**
Discount allowed for prompt payment and period within which invoice must be paid to qualify.	%	

NOTICE OF NO BID

INSTRUCTIONS:

It is important to the Toronto Zoo to receive a reply from all invited bidders. If you are unable, or do not wish to submit a bid, please complete the following portions of this form. State your reason for not bidding by checking the applicable box(es) or by explaining briefly in the space provided. It is not necessary to return any other Request for Proposal/Quotation/Tender documents or forms. Please just return this completed form by fax or by mail prior to the official closing date. Purchasing and Supply Fax Number: (416) 392-6711.

A Proposal/Quotation/Tender is not submitted for the following reason(s):			
	Project/quantity too large.	.	Project/quantity too small.
	We do not offer services or commodities to these requirements		Cannot meet delivery or completion requirement
	We do not offer this service or commodity.		Agreements with other company do not permit us to sell directly.
	Cannot handle due to present commitments.		Licensing restrictions
	Unable to bid competitively.		We do not wish to bid on this service or commodity in the future.
	Insufficient information to prepare quote/proposal/tender		Specifications are not sufficiently defined
	We are unable to meet bonding or insurance requirements.		

Other reasons or additional comments (please explain):

Company Name:	
Address	
Contact Person:	
Signature of Company Representative:	
Date:	
Phone Number:	
Email address	
Fax Number:	

SUBMISSION LABEL

This address label should be printed and affixed to the front of your sealed tender, quotation and proposal envelope/package submission. Toronto Zoo will not be held responsible for envelopes and packages that are not properly labeled or submitted to an address other than the one listed on this label.

Proponent Name _____

RFP 12 (2018-03)- SITE SERVICES STUDY
Closing: Thursday, 2018-04-19, 12:00 hours (noon) local time

TO BE RETURNED TO

TORONTO ZOO
ATTENTION: SUPERVISOR, PURCHASING & SUPPLY
ADMINISTRATIVE SUPPORT CENTRE
361A OLD FINCH AVE.
TORONTO, ONTARIO
M1B 5K7

FEE PROPOSAL FORM

Proponent Name				
	FEES	**DISBURSEMENTS**	**HST**	**TOTAL**
Site Inspection/Assessment				
Interim Report				
Final Report				
Disbursement Allowance				
TOTAL COSTS				

LEGEND:

- COMMUNICATION
- IRRIGATION
- HIGH VOLTAGE
- HYDRO
- WATER
- GAS
- STORM
- SANITARY
- FIBRE OPTICS
- DUCT BANK ROUTING
- ROAD CROSSING/ CONCRETE ENCASED DUCTS
- DIRECTIONAL BORING
- POWER MANHOLE
- COMMUNICATIONS MANHOLE

toronto ZOO

361A OLD FINCH AVE.
TORONTO, ON
M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24
2	FOR REVIEW BY PM	2015.12.10

NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

SITE SERVICES

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
SCALE:	1:5000

DRAWING #:

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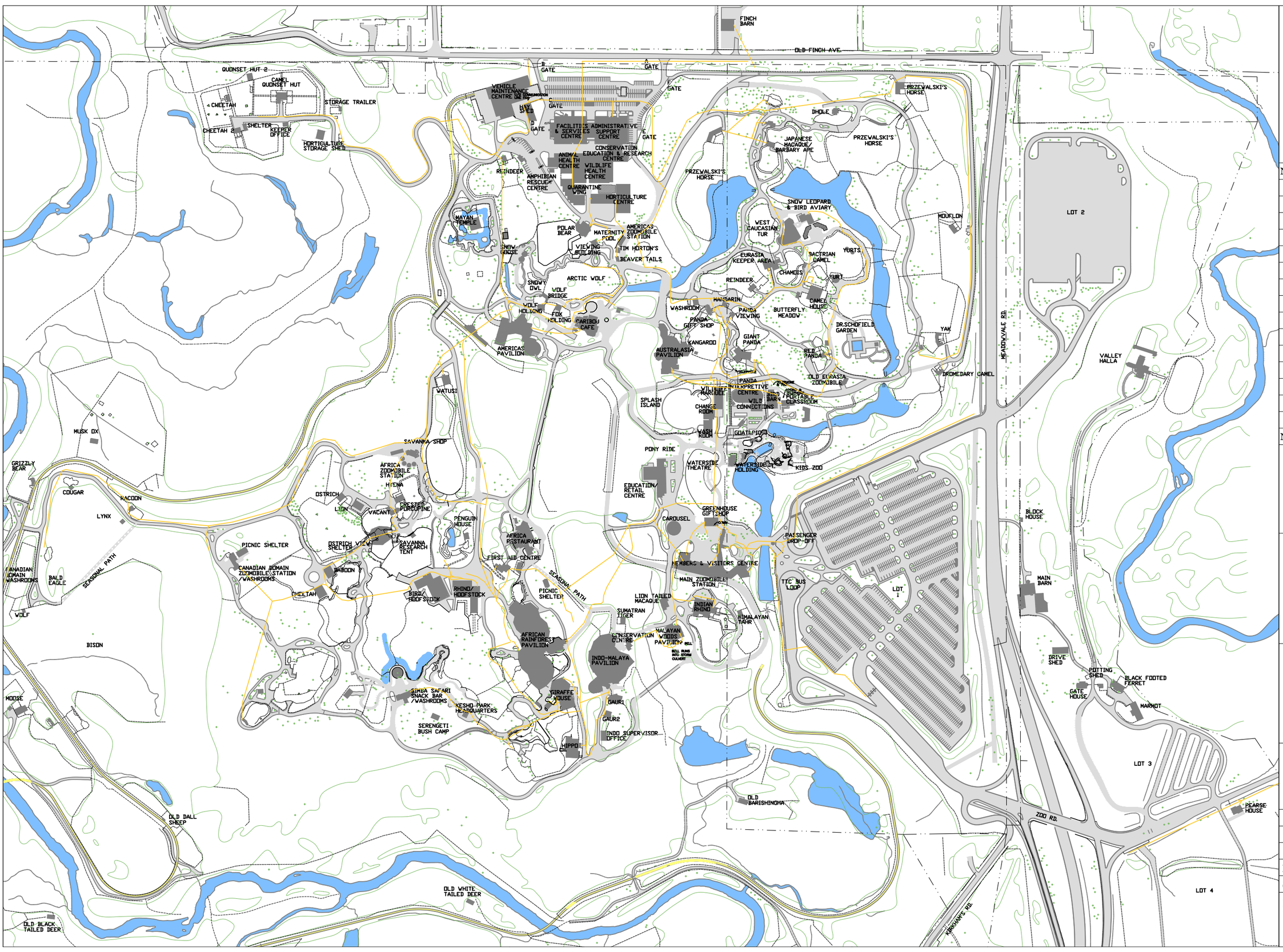

toronto ZOO

361A OLD FINCH AVE.
TORONTO, ON
M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24

NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

COMMUNICATION

PROJECT #:	SITE SERVICES
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CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
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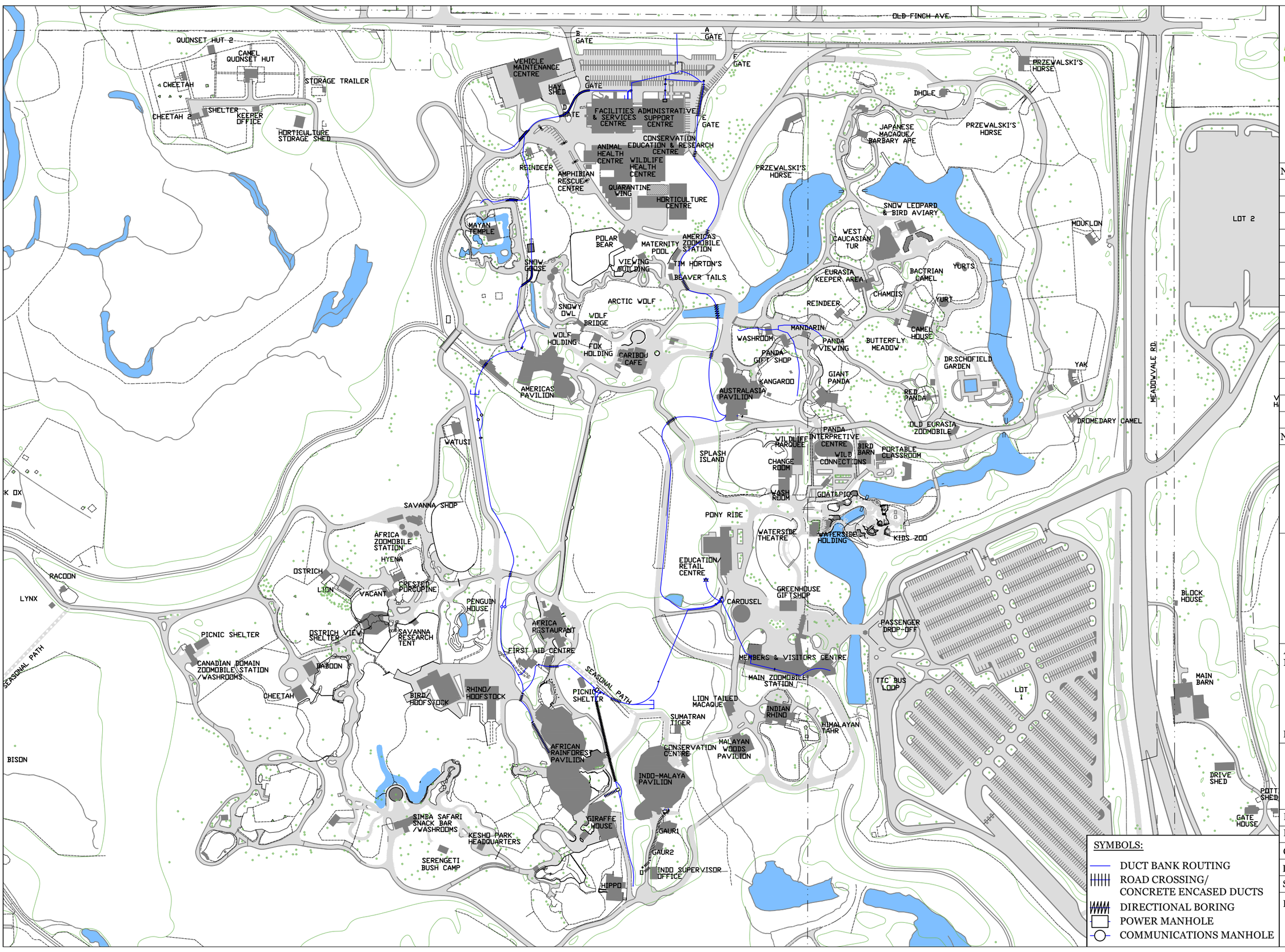

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M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24
NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

HIGH VOLTAGE

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
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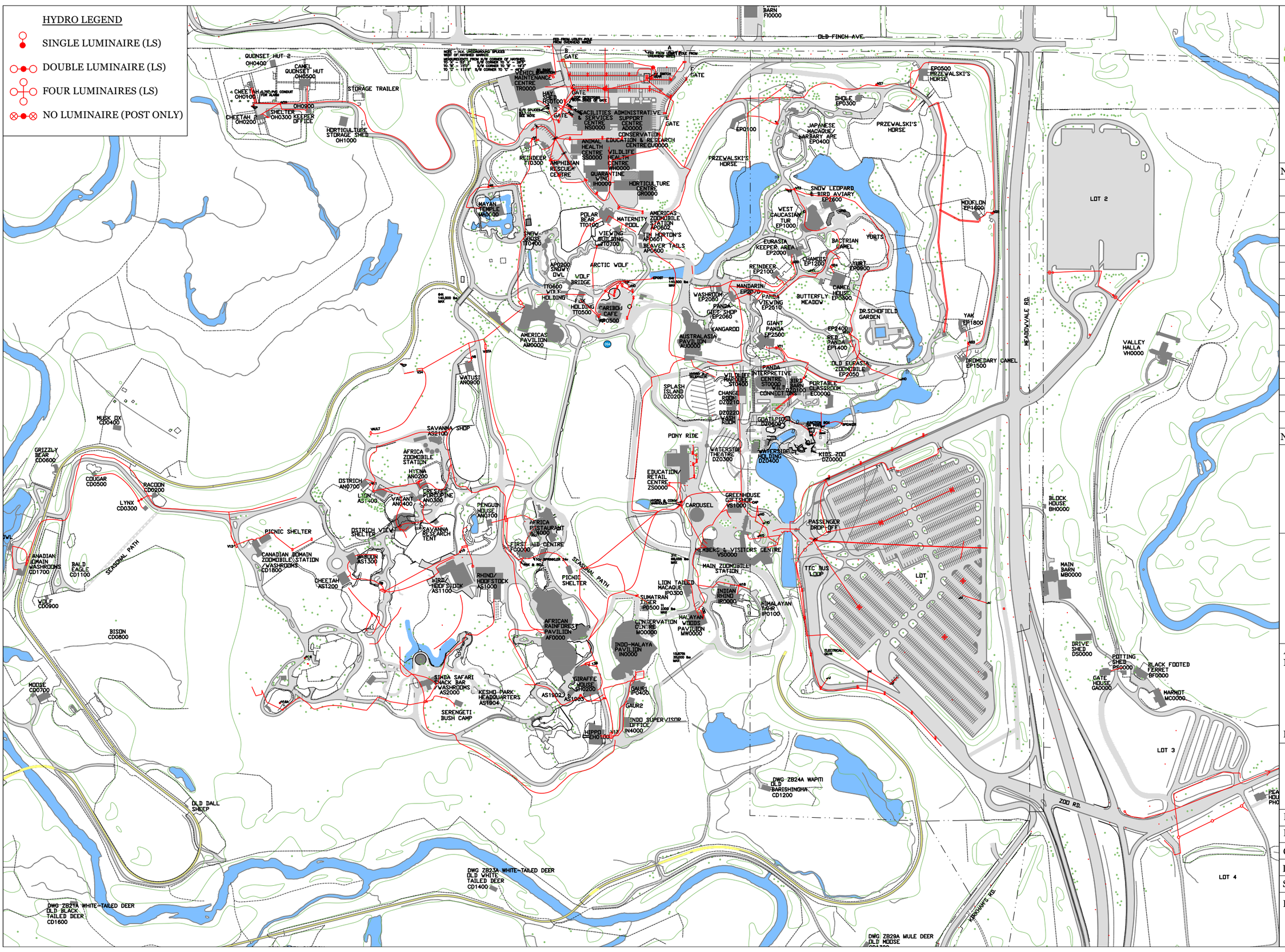

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TORONTO, ON
M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24
NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

HYDRO

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
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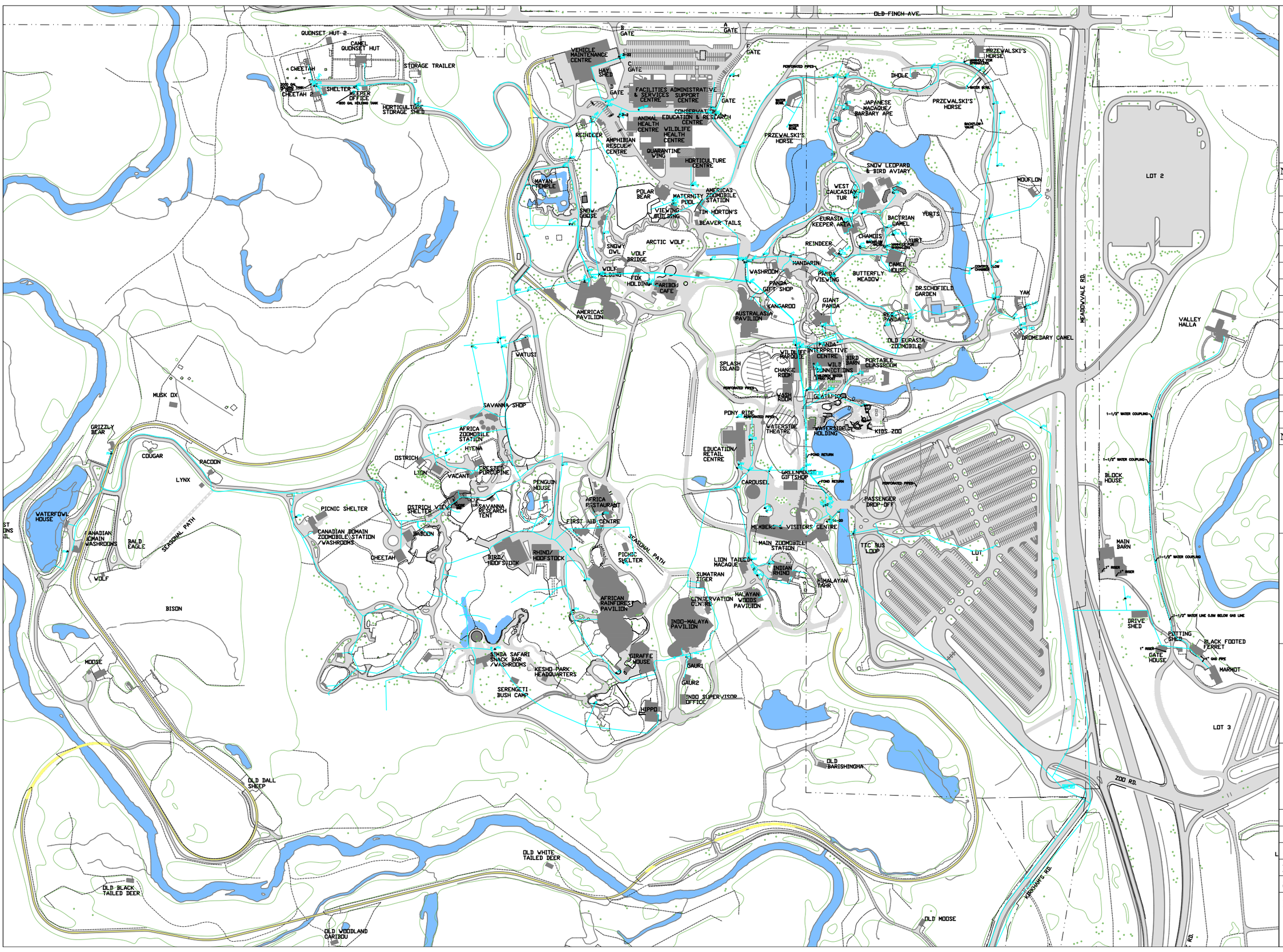

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M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24

NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

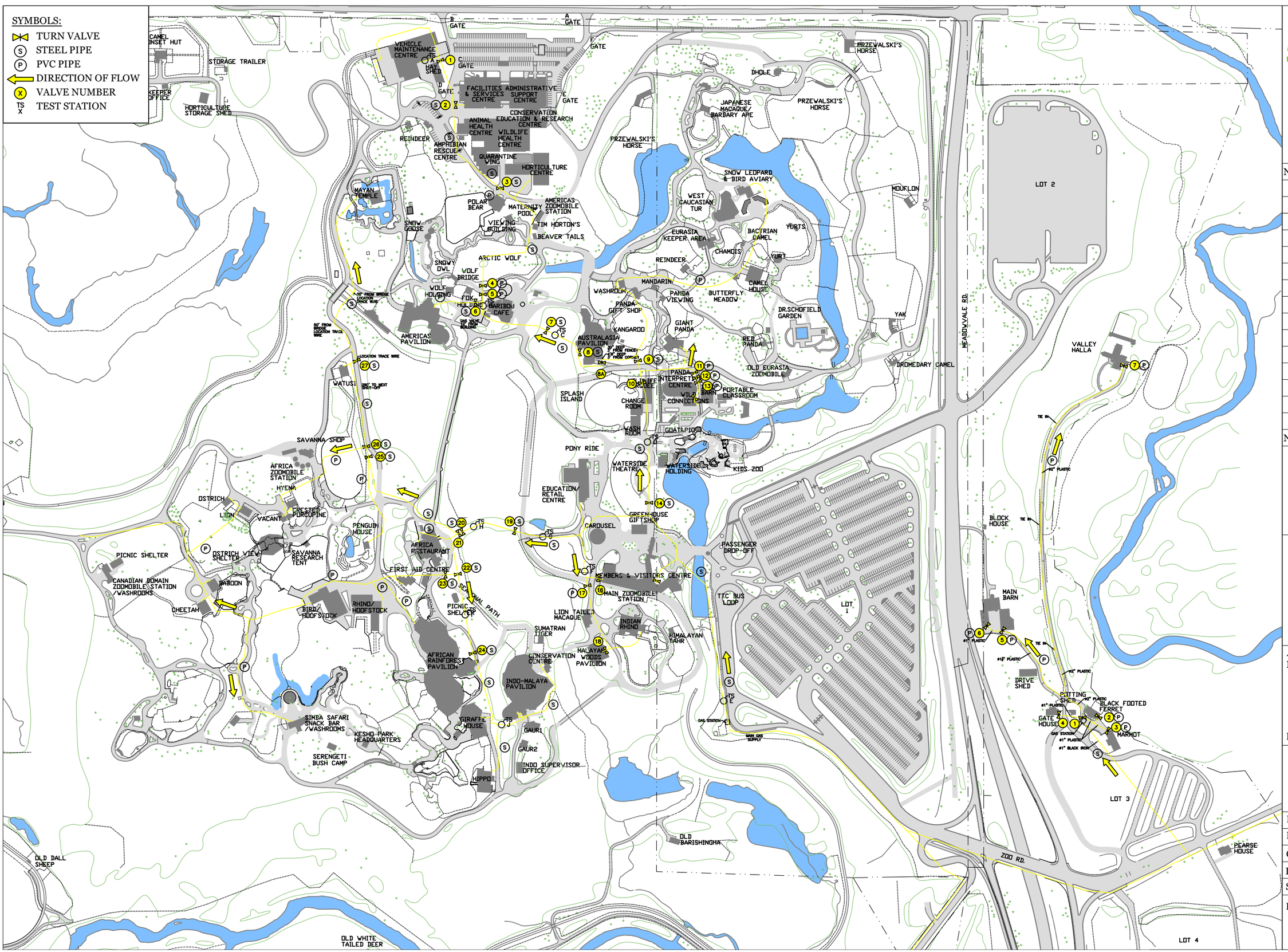
WATER

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
SCALE:	1:5000

DRAWING #:

A3.07

SYMBOLS:
- TURN VALVE
- STEEL PIPE
- PVC PIPE
- DIRECTION OF FLOW
- VALVE NUMBER
- TEST STATION



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361A OLD FINCH AVE.
TORONTO, ON
M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24
2	INDIAN RHINO AREA	2017.05.02

NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

GAS LINES

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
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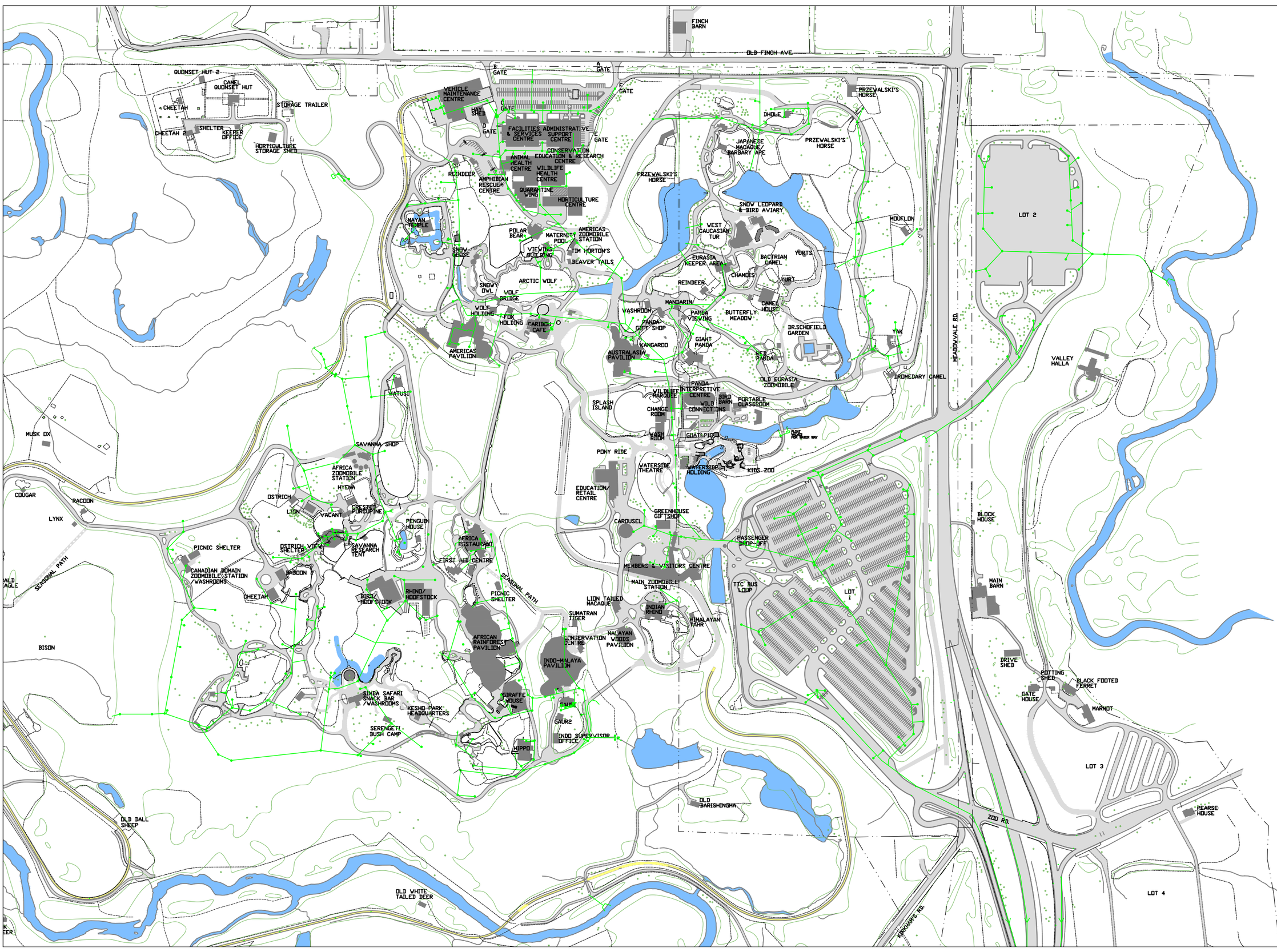

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TORONTO, ON
M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24
NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

STORM

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.12.14
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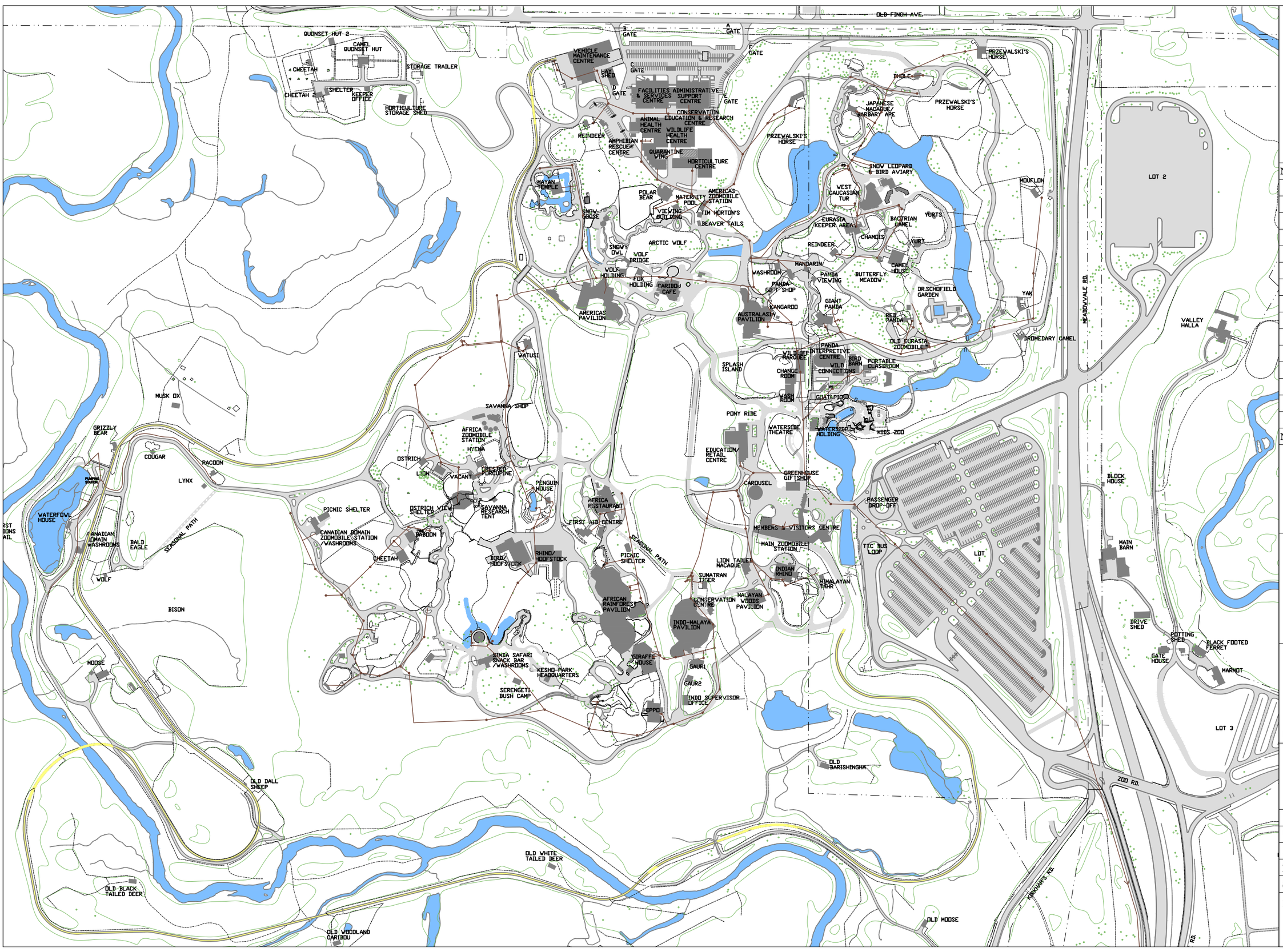

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TORONTO, ON
M1B 5K7

NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24

NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

SANITARY

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
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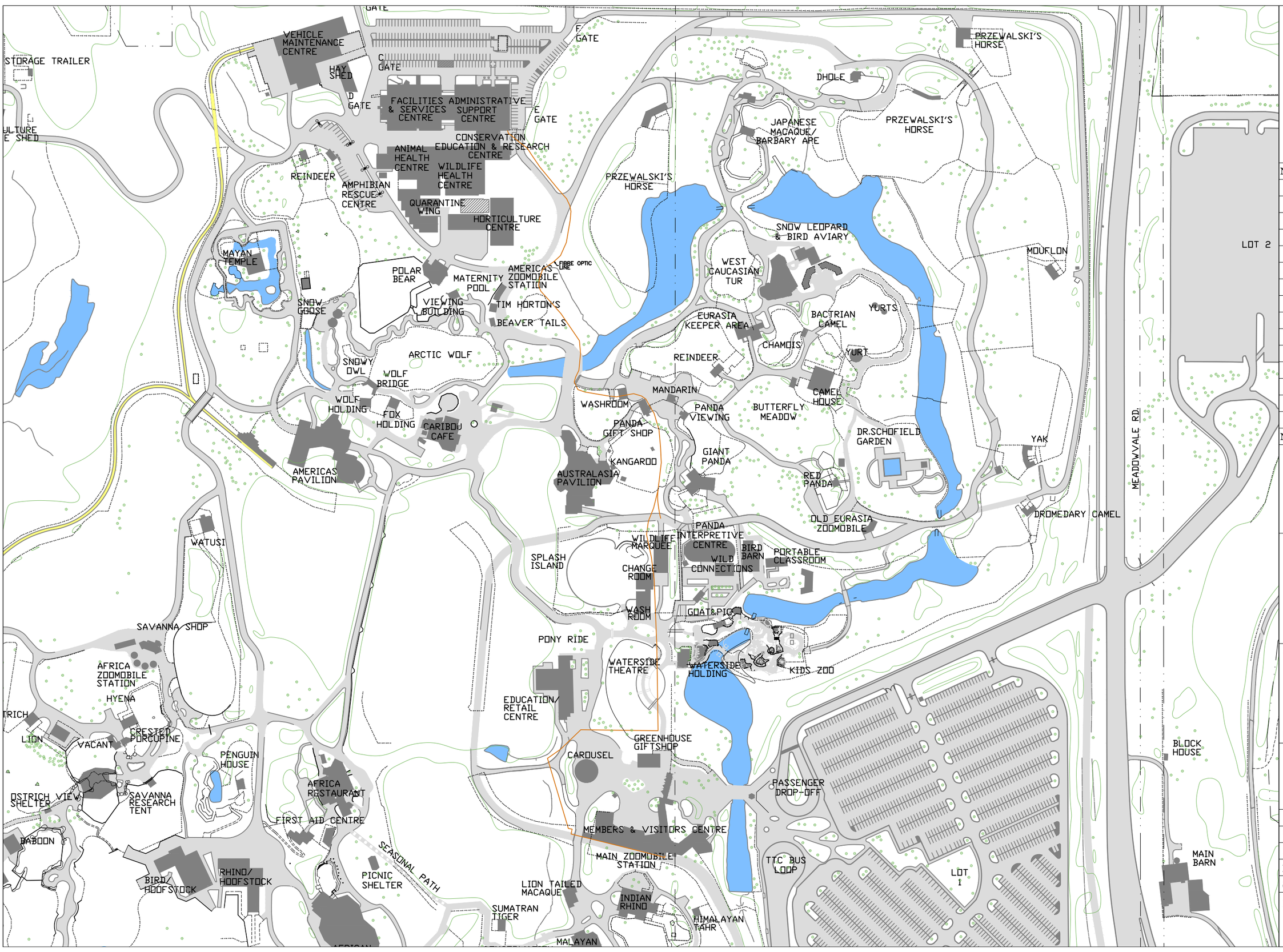

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NO.	DESCRIPTION	DATE
1	FOR REVIEW BY PM	2015.11.24

NO.	REVISIONS	DATE

SITE PLAN

APPROVED BY
NAME:

DATE:

FIBRE OPTICS

PROJECT #:	SITE SERVICES
DRAWN BY:	D.G.
CHECKED BY:	LEONA MITCHELL
DATE:	2015.11.23
SCALE:	1:3000

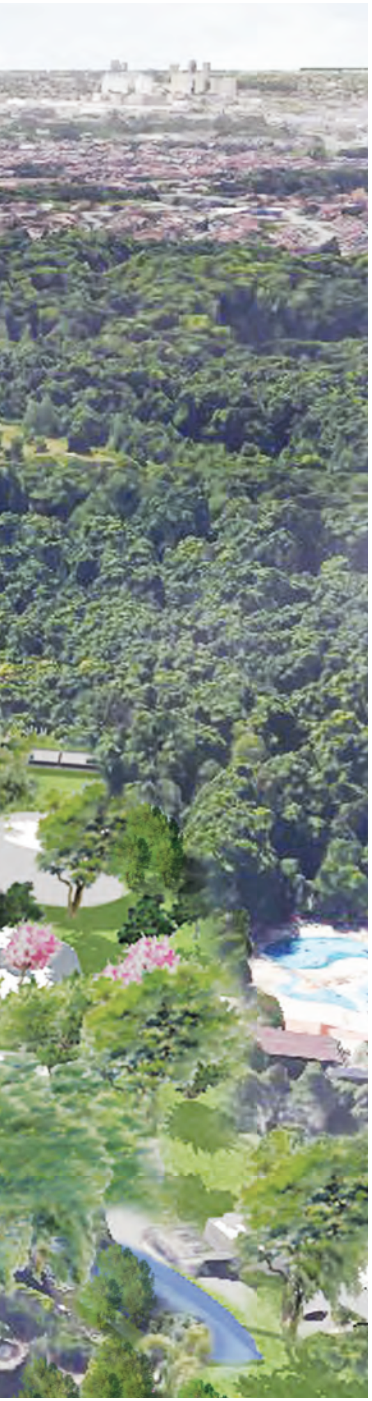
DRAWING #:

A3.11

toronto zoo

2016 MASTER PLAN

Securing a Sustainable Future



toronto zoo

MASTER PLAN

prepared by:

MMM Group Limited + Studio Hanson / Roberts

in consultation with:

Lord Cultural Resources

Schultz & Williams

Balind Architects

Oppenheim Lewis

CEO INTRODUCTORY LETTER

The past twenty-five years has seen unprecedented changes to our environment and biodiversity on our shared planet resulting in the world losing more than 10,000 species a year. Now more than ever, modern accredited zoos are needed to ensure the ongoing survival of many of the world's most vulnerable species, and their habitats, including Canadian species. In our own backyard, species at risk like the Blanding's turtle, eastern loggerhead shrike, eastern massasauga rattlesnakes, black-footed ferrets, wood bison, Vancouver Island marmots, moose and bats, to name just a few, are in desperate need of our help. The Toronto Zoo must make significant investments now and in the future to ensure that wildlife and their habitats are sustainable for future generations.

In 1990, the Toronto Zoo announced an ambitious Capital Master Plan that laid the foundation for the next twenty-five years. The vast majority of those projects were completed and award-winning exhibits were introduced throughout the Zoo's 700 acres. With the completion of that Master Plan in 2015, and the creation of a new five-year strategic plan, it was time to develop a framework for the next 15-20 years that was reflective of the Zoo's new mission, vision, goals and objectives as well as the changing demographics in Canada's most populated region. Coupled with the announcement of the creation of the Rouge National Urban Park (RNUP), which makes us the only zoo in the world to be located at the gateway to a national park, the timing could not have been better to map out the growth strategy for the next two decades. This provides the Zoo with unlimited opportunities for partnerships with likeminded organizations that are share the common mission of sustaining wildlife populations and their habitats for future generations.

The Toronto Zoo is no longer the Zoo of twenty-five years ago where a visitor would come just to see animals from the world. Now, the animals you see throughout the site represent only a portion of the work that is being done here through our programs to support species in the wild. The Zoo is a very dynamic organization providing compelling guest experiences that educate visitors about the animals in our care and also inspires them to take actions to protect them. This a very exciting time for everyone at the Toronto Zoo – we are very proud of the work we do here, especially with leading veterinary, reproductive and nutritional sciences, education and wildlife care and we look forward to highlighting this critical work to our visitors and the greater community at large through new programming and partnership opportunities.

I invite you to read our Strategic and Master Plans and join us in supporting our mission of being a living centre for education and science, committed to providing compelling guest experiences and inspiring passion to protect wildlife and habitats. We are confident you will share our vision to be Canada's national leader in saving wildlife to ensure the rich diversity of nature for future generations.

John Tracogna
Chief Executive Officer

December, 2016

TABLE OF CONTENTS

INTRODUCTION

KEY MESSAGES

The Master Plan will:

- Work in tandem and alignment with the Strategic Plan and its objectives with a particular emphasis on magnifying the Zoo's conservation impact by:
  - » Providing exemplary care to the Zoo's wildlife population, both behind the scenes and in day-to-day engagement with our guests;
  - » Enhancing the guest experience to appeal to a more diverse – and increasingly urban – audience;
  - » Inspiring current and future generations to become active stewards of wildlife and wild places.
- Guide the capital and programmatic development of the Toronto Zoo and will assist the Zoo in maintaining its reputation as a leading zoological organization internationally by guiding focused and cohesive capital investment.
- Facilitate development in a manner that drives higher attendance, earned revenues and compelling educational content if adequate capital investment is made in alignment with the Master Plan.
- Help inform the fundraising objectives of the new Foundation.
- Refocus on Canadian wildlife species.
- Represent a unique piece of major infrastructure and facilitate an opportunity to compliment and integrate a mutual alignment of values, mission and objectives with the Rouge National Urban Park.
- Help build the Greater Toronto Area as a great Region providing easy access to wildlife education/learning and nature based experiences, and by engaging in important wildlife conservation endeavours.
- Benefit human efforts in mitigating the impacts of climate change and promote biodiversity, locally, nationally and internationally.
- Foster a climate of innovation and collaboration with key partners such as conservation and environmental NGO's, key academic institutions, government and private sector partners, and other wildlife organizations, who all wish to enhance the economic prosperity and cultural fabric of the region.
- Assist the Board and its staff in the essential quest to ensure that the Zoo's habitats and holdings continue to meet our evolving understanding of the welfare needs of the animals in our care.

Grevy Zebra Conservation Breeding Program

BACKGROUND

The initial plan for the creation of a zoo for the City came about in 1966 when the Municipality of Metropolitan of Toronto approved the formation of a committee to investigate the feasibility of a large scale zoo located within its municipal boundaries. As a result, in 1969, a master plan was created by Johnson Sustronk Weinstein and Associates.

The Toronto Zoo opened in 1974, situated on 287 hectares (710 acres) of land in the picturesque Rouge Valley, in northern-eastern Toronto. The Zoo aimed to provide Torontonians with exposure to and an understanding of the world's zoogeographic regions and oceans. The Zoo created several representative zones, including Indo-Malaya, Africa, the Americas, Australasia, Eurasia and the Canadian Domain.

Part of the initial planning of the 1969 plan was completed by Canadian architect, Ron Thom, who also designed the Zoo's two signature structures, the Indo-Malaya and Africa Pavilions, in collaboration with structural engineer Morden Yolles. These buildings represent "the last heroic, large-scale projects of post-war Canadian Modern architecture"[1] and aimed to create "spaces as non-building-like as possible in a continuous environment of humans, flora and fauna." [2] Today they form the Zoo's largest indoor habitats and are the prime destination for mid-winter visits.

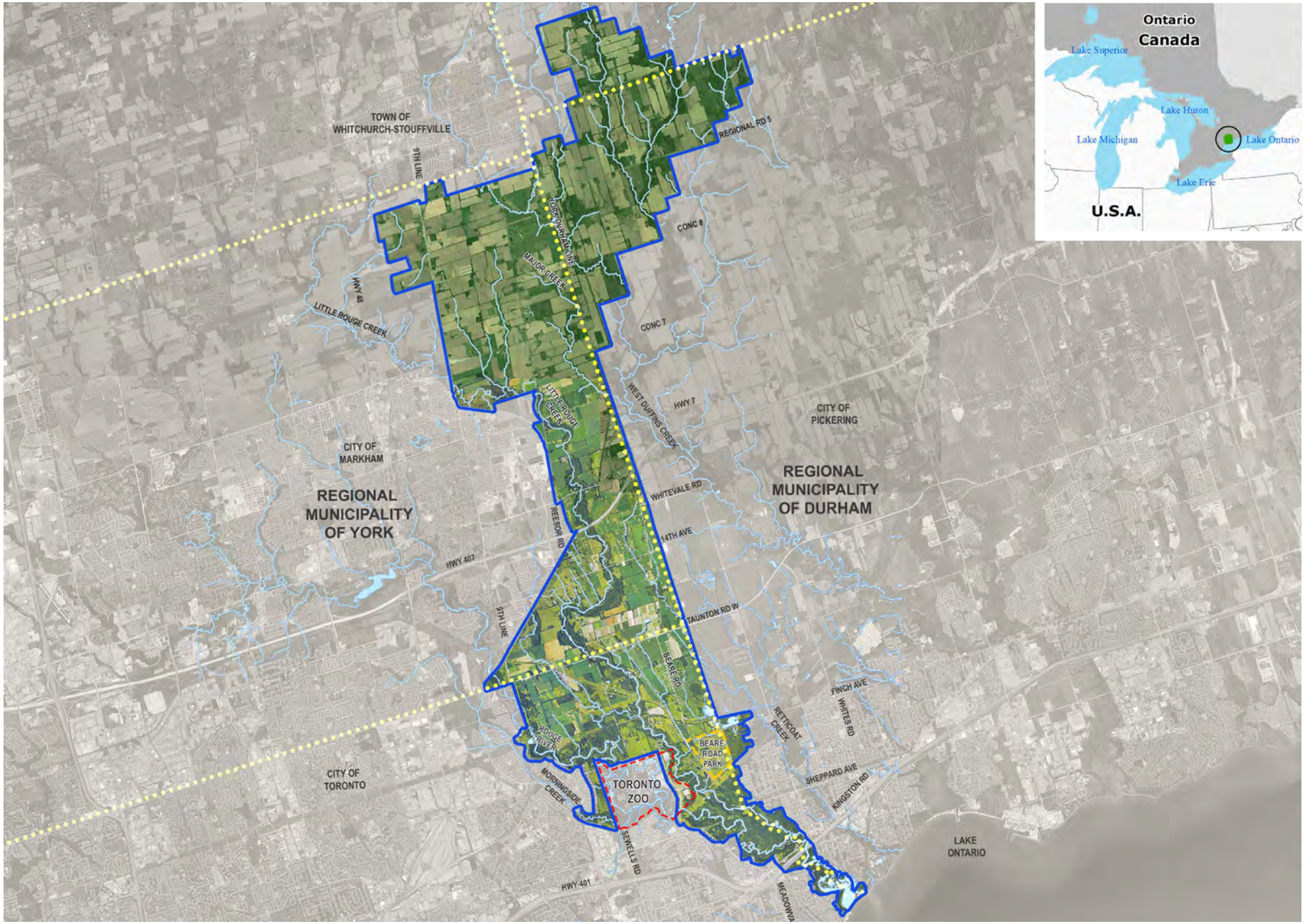
In 1986 Marshall Macklin Monaghan Limited (now MMM Group) updated the original Master Plan, and in 1990 the Capital Master Plan was approved by Metro Council and utilized over the following 25 years.

Subsequent major developments include the large, experientially integrated outdoor landscapes of the Savanna and Tundra Trek, however much of the interstitial exhibits and spaces remain relatively unconnected and with limited impact. The Canadian Domain has remained as a long hike down the hill to the banks of the Rouge River, and is comprised primarily of large hoofed stock enclosures. Given the environmental sensitivity of this area and the potential for flooding, future plans will be comprised of low-impact uses, off-exhibit breeding areas and tour-guided experiences, with major visitor experiences and public learning opportunities moved to the 'top of the hill' on the tablelands.

The Zoo, which celebrated its 42nd anniversary in August of 2016, attracts an average of 1.3 million visitors annually, and is one of the largest and most progressive zoos in North America.

This current Master Plan takes the work of previous Master Plans, as well as a number of other plans and studies of the Zoo that have been undertaken over the years, into consideration as part of the background review. It also takes into account the new Toronto Zoo Mission, Vision and Core Values as well as the seven strategic goals identified in the 2015-2020 Strategic Plan.

During the Master Plan preparation, several projects are being undertaken concurrently. As part of the Master Plan a Market Analysis has been developed and the Toronto Zoo Building Audit was completed in early 2016, and informs this report.



CONTEXT MAP FIGURE 1

Rouge National Urban Park Location

CONTEXT

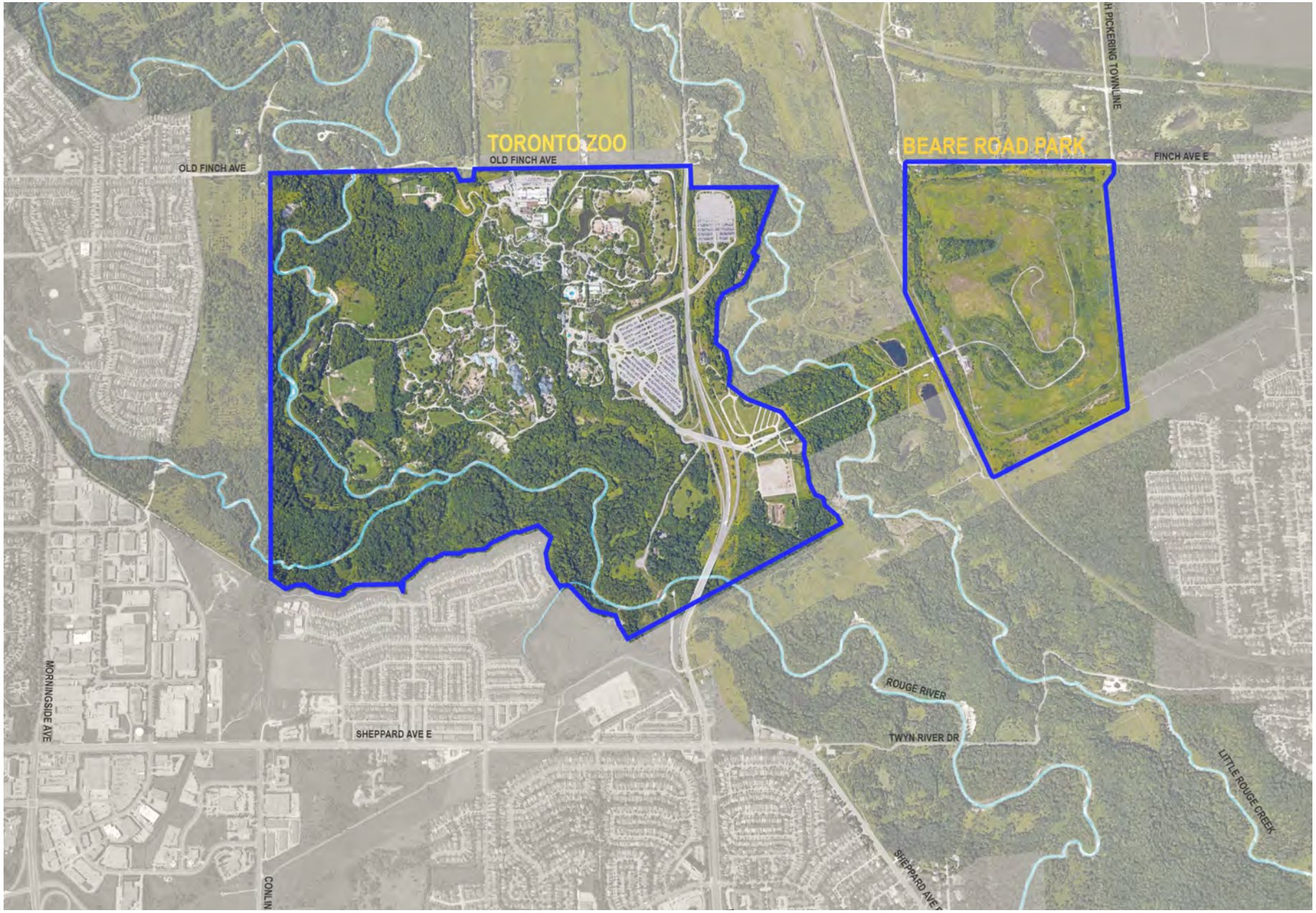
The Toronto Zoo is home to more than 5,000 animals, representing more than 450 species and 300 exhibits with an even larger plant population. The majority of the site governed by the Board of Management of the Toronto Zoo, is currently owned by the Toronto and Region Conservation Authority (TRCA), and a smaller portion 40 hectares (100 acres) is owned by the City of Toronto and managed under a tripartite agreement. The Zoo sits within the Rouge National Urban Park, north of Highway 401, on the forested slopes and tablelands that lie between the Rouge River and the Little Rouge Creek. The site is generally bounded by Old Finch Avenue to the north, Little Rouge Creek to the east, Rouge River to the west and Upper Rouge Trail Park to the south (see Figure 2). An expanded study area that includes the entire Toronto Zoo site and surrounding context of part of the Rouge Valley has been considered in some aspects of analysis. The surrounding area is composed of small farm holdings in the upland areas, as well as larger farms in the valley. There is still considerable agricultural influence in the area with large u-pick farms, as well as meandering forest lands along the rivers. Eventually, a trail system, combined with conservation and public use programs, will unite the entire area and provide a fertile focus for the Toronto Zoo to collaborate with Parks Canada on native species conservation programs and educational outreach.

Future development under an updated tripartite agreement will include Zoo land to the east of Meadowvale Road where facilities, programming, and visitor experiences support both the Zoo and Parks' conservation and sustainability efforts. Also included is land area to the north of Old Finch Avenue, where relocated facilities will be provided for conservation breeding and reproductive research, and new areas will be lushly planted for browse and nutrition gardens.

In 2011, the Government of Canada announced the creation of the Rouge National Urban Park (RNUP) as part of the national parks system. The Toronto Zoo is located adjacent to the RNUP, which creates a tremendous potential for synergies between the Zoo and the new park.

1. Beth Kapusta and John McMinn, "Engineering Canadian Modernism," *Canadian Architect: The National Review of Design and Practice*, April 1, 2001, https://www.canadianarchitect.com/features/engineering-canadian-modernism/

2. Ibid.



SITE CONTEXT MAP FIGURE 2

Adjacency to Parks

METHODOLOGY

The master plan was produced from a ten step process as outlined below. The process was documented in three progressively more detailed reports, an Initial report in the fall of 2015, an interim report in February of 2016 and the final report in early October 2016.

Step 1: Market Analysis Report

The Market Analysis is the first phase of the overall Master Plan that will guide the development of the Toronto Zoo over the next 15-20 years. The Master Plan is to reflect the new mission and vision statements for the Toronto Zoo.

A key difference from previous strategic plans for the Toronto Zoo is that the current plan makes conservation impact the primary focus.

The Market Analysis is set out in the following categories:

- The Toronto Zoo in the context of other zoos
- The Toronto competitive context
- Existing markets for the Toronto Zoo
- Potential markets for the Toronto Zoo
- Zoo, attractions and travel trends

Step 2: Background and existing conditions review and site tour

At the outset of the master plan, selected background materials and data were reviewed, including the 2015-2020 Toronto Zoo Strategic Plan and documents related to Financial, Visioning, Programs / Human Resources, Visitors / Market, Standards / Guidelines, Adjacent Land Use and other zoo master plans.

An observational, photographic and background document review was conducted of existing Zoo facilities including:

- Exhibits
- Off-Exhibit Holding Areas
- Public Spaces & Amenities (washrooms, retail)
- Rental Spaces
- Operations Areas
- Visitor & Services Circulation
- Administrative & Staff Areas
- Programs

During the summer of 2015 master plan team members and Zoo representatives carried out an initial tour of the Zoo site. The tour provided the master plan team with an overview and familiarity with the Zoo prior to a three day staff workshop in September.

Step 3: Identify and review trends

Current zoo planning and design trends and recent developments were presented at the September workshop.

Step 4: Consultations

Over the duration of the master plan process a series of meetings was held with the Steering Committee regarding the emerging content of the Master Plan. In addition a series of face to face interviews with selected management staff and stakeholders was carried out prior to the preparation of the Interim Report.

Meetings were arranged with staff from all areas of the Zoo.

In addition, meetings were arranged with Parks Canada staff to determine opportunities for joint programs and capital projects. The consultation was informed by background reviews and the existing professional familiarity of the local team with the two institutions.

Indian Rhino Conservation Breeding Program

Step 5: Fall Workshop, Master Plan Training Session with Board and Initial Report

The staff workshop brought together members of the master plan team with the Zoo team. Key Zoo staff as well as team members from MMM Group, Studio Hanson Roberts, Lord Cultural Resources, Schultz & Williams and Balind Architects were present.

A work-shop was held in December, 2015 with the Board of Management.

The information gained supplemented the review process and formed the basis for the Initial Report which included a conceptual design approach and initial thoughts about a high level plan.

Step 6: Workshop #3

After completion of the Initial Report, a third workshop was held in February with selected Zoo staff and site design specialists from the MMM Group and Studio Hanson Roberts. Follow-up face to face interviews were conducted with appropriate Zoo staff and key individuals. This workshop considered alternatives to the conceptual design approach and resulted in a preferred alternative.

Step 7: Consolidation and Interim Report

Define the Vision:

- "what is the Zoo in relation to the world of zoos and aquariums?"
- "what is the Zoo in relation to other cultural – green – community organizations in Toronto?"
- "what is the Zoo in relation to the world of animal welfare and conservation organizations?"

After completion of the Initial Report, the team members performed due diligence on the information gained, as well as conducted follow-up phone interviews with appropriate staff and key individuals.

Key aspects were documented and informed by the results of the building audit that is prepared by others. An Interim Report was prepared in February 2016. This report discussed findings, defined planning principles, defined "green" goals and strategies and documented approaches developed at the workshop in February 2016.

Step 8: Complete Development Plan & Prepare Draft Final Report

The conceptual development plan was refined and provided to the Zoo for review and to the Marketing & Financial Planning Consultants for their use in developing recommendations.

Step 9: Complete Financial Plan

A Financial Plan was developed after receiving comments from the Zoo on the Draft Final Plan.

Step 10: Marketing Plan and Final Report

The Final Report refines the direction of the Master Plan and provides a picture of what the Zoo will look and feel like. It provides a list of achievable capital projects and project components within a 15-20 year horizon, and establishes a phasing strategy with associated costs and operational considerations.

A Marketing Plan was developed in parallel with the site design. This Final Report includes illustrative plans and sketches.

Ailurus fulgens - Red Panda

THE VISION

THE VIEW FROM HERE

The Toronto Zoo, located on a high point of land and covering more than 700 acres between the Rouge River and Little Rouge Creek is poised to realize a transformational vision.

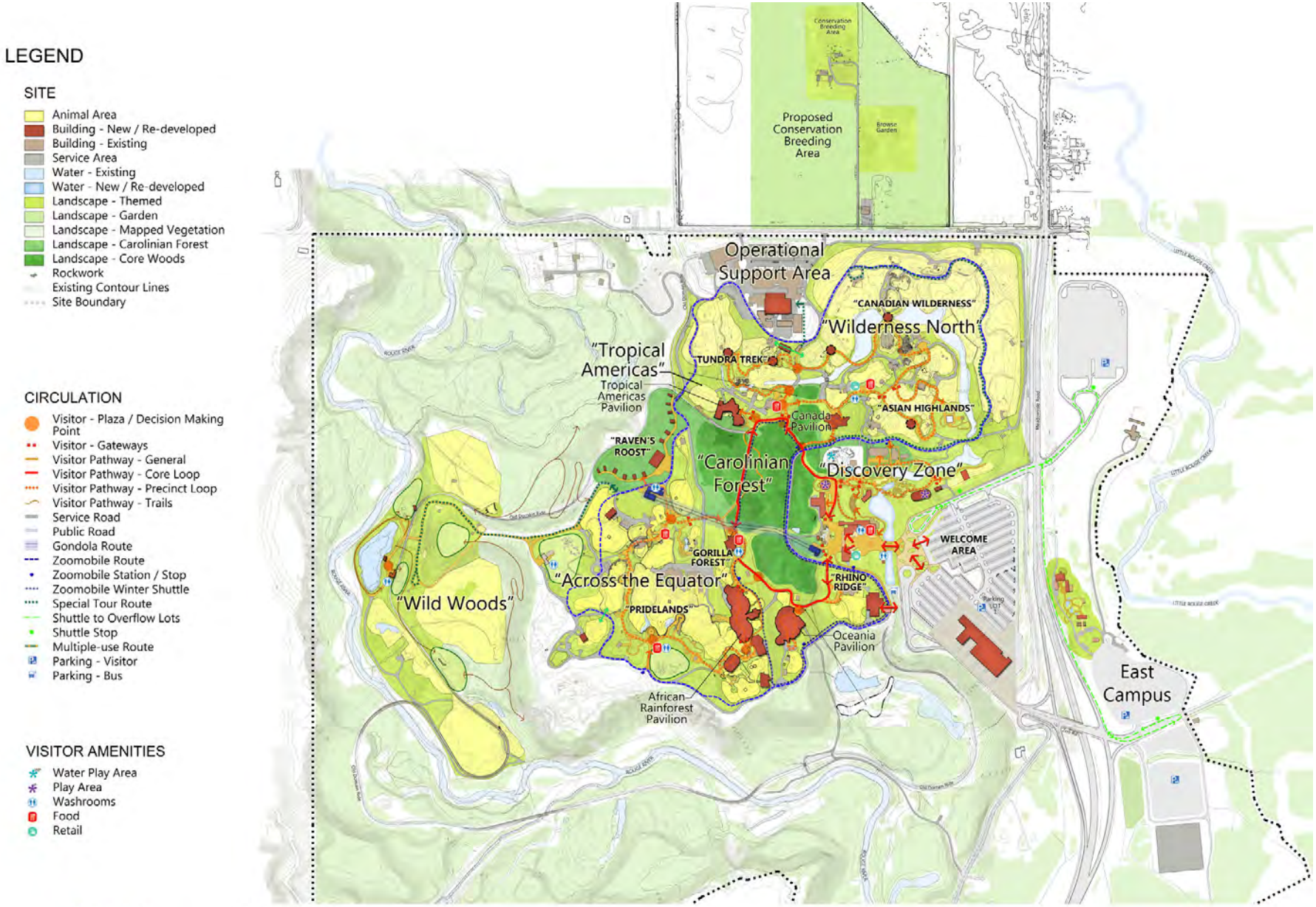
Building on its recently completed Strategic Plan and supported by this comprehensive Master Plan which lays out a developmental path for the next 15 to 20 years, it stands ready to take advantage of its history of innovation and move confidently forward with the next steps of reinvestment and renovation that will enable it to take even better care of its animals, its guests and the surrounding native forest that forms such a strong thread running through the Zoo.

With a focus on wildlife conservation and a determination to continue to expand partnerships with local citizens, as well as leading local and international organizations, the Toronto Zoo will strengthen and advance its reputation as a conservation centre of excellence that actively involves its guests and sends them forth with a renewed awareness of the needs of wildlife and wild places, and sense of purpose.

This Master Plan has been produced with input from the Zoo Board of Management and Staff, as well as the Toronto and Region Conservation Authority, City of Toronto, Parks Canada, the University of Toronto Scarborough and numerous other stakeholders. Through such broad outreach and consensus-building, the Toronto Zoo will be able to build upon its international reputation in wildlife conservation to step confidently into a role of one of the most significant places of regional conservation activities and sustainably-managed habitats in the Greater Toronto Area.

The Zoo will be a prime gateway to the ecosystems of the Rouge National Urban Park and the Rouge River watershed. With its evolving education and research facilities, it will be a national destination for research of species at risk and education about native and exotic species and habitat conservation. To support this, the Master Plan envisions not only expanded and enhanced habitat areas for the Canadian and exotic animals in its care, but a revitalized welcome area that reflects the higher purpose of the Zoo, a new learning centre and 4-season children's nature play area, restored wetlands and forests, and a variety of overnight facilities where Canadians can get closer to the nature that is in their midst.

The Master Plan reflects the need for an innovative 21st century wildlife conservation park that is environmentally and fiscally sustainable for the long term. To accomplish this, the Toronto Zoo will move confidently into its role as a world leader advocating for and advancing wild welfare, wildlife conservation and habitat preservation while also delivering enhanced and engaging guest experiences that inspire and educate present and future generations.


LEGEND
SITE
Animal Area
Building - New / Re-developed
Building - Existing
Service Area
Water - Existing
Water - New / Re-developed
Landscape - Themed
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Zoomobile Station / Stop
Zoomobile Winter Shuttle
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Multiple-use Route
Parking - Visitor
Parking - Bus
VISITOR AMENITIES
Water Play Area
Play Area
Washrooms
Food
Retail
Proposed Conservation Breeding Area
Operational Support Area
"Tropical Americas"
Tropical Americas Pavilion
"Wilderness North"
"CANADIAN WILDERNESS"
"TUNDRA TREK"
"ASIAN HIGHLANDS"
Canada Pavilion
"RAVEN'S ROOST"
"Carolinian Forest"
"Discovery Zone"
WELCOME AREA
"GORILLA FOREST"
"Across the Equator"
"RHINO RIDGE"
"PRIDELANDS"
"Wild Woods"
Oceania Pavilion
African Rainforest Pavilion
East Campus
Master Plan
Toronto Zoo Master Plan
November 2016
MMM GROUP

FIGURE 3

MISSION AND VISION FOR THE ZOO

OUR MISSION

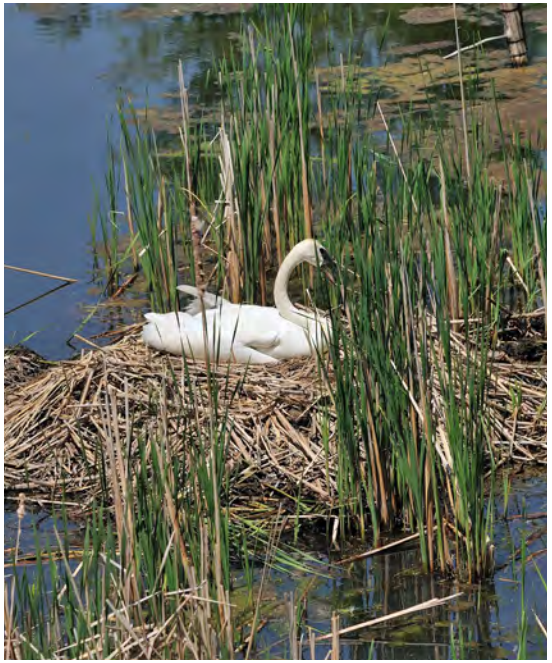
A living centre for education and science, committed to providing compelling guest experiences and inspiring passion to protect wildlife and habitats.

OUR VISION

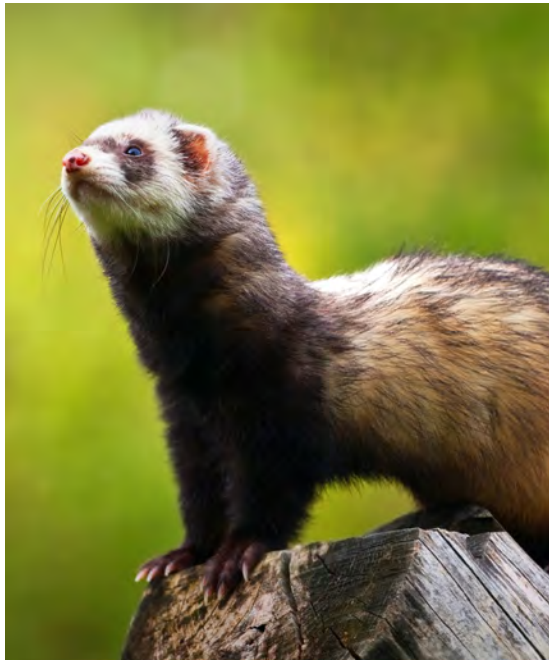
Canada's national leader in saving wildlife to ensure the rich diversity of nature for future generations.

Lanius ludovicianus migrans - Eastern Loggerhead Shrike

Canis lupus arctos - Arctic Wolf



Cygnus buccinator - Trumpeter Swan



Mustela nigripes - Black Footed Ferret

CORE VALUES FOR THE ZOO

The following Core Values of the Toronto Zoo were developed in the 2015-2020 Strategic Plan to ensure that the evolving plan for the Toronto Zoo continues to be true to the Vision:

EXCELLENCE

We ensure the highest standard of care for wildlife, provide excellent guest service and create fun and transformational experiences that connect people to nature.

CONSERVATION

We are committed to practicing and promoting activities and actions that benefit wildlife and the environment.

INNOVATION

We encourage creativity, strive to think differently and turn our ideas into actions.

COLLABORATION

We conduct ourselves in a manner that fosters respect and teamwork among staff, volunteers and our partners to achieve our mutual goals.

INTEGRITY

We are transparent and committed to best practices and leading by example.

PASSION

We are proud, energetic and passionate about saving wildlife and will inspire others to value the critical role of our Zoo.

GOALS AND OBJECTIVES

Seven goals emerged in the strategic planning process and represent the Zoo's strategic direction for the next five years.

Fourteen selected objectives are addressed directly in this master plan.

GOALS

GOAL 1 - CONSERVATION IMPACT
Advance to a zoo-based conservation centre of excellence

GOAL 2 - GUEST ENGAGEMENT
Enhance the guest experience to appeal to a more diverse audience and inspire conservation action

GOAL 3 - GOVERNANCE
Enhance the governance structure

GOAL 4 - FINANCIAL STABILITY
Build an organization that is fiscally and environmentally sustainable for the long term

GOAL 5 - STRATEGIC ALLIANCES
Maximize existing partnerships and **identify new opportunities**

GOAL 6 - PEOPLE
Create an organizational culture that attracts, **engages and retains highly motivated staff** and volunteers

GOAL 7 - UNDERSTANDING & CARING
Increase awareness, understanding and support of the Zoo as a centre for conservation excellence

OBJECTIVES

Establish the Toronto Zoo as the national leader in wildlife conservation, with a focus on Canadian species and habitats.

Achieve a sustainable wildlife population with a high degree of biodiversity within the Zoo.

Provide exemplary care to the Zoo's wildlife population.

Invest in renewal of facilities and infrastructure to meet and exceed industry standards.

Revitalize existing exhibits and amenities and develop new memorable experiences, to increase support for the renewed mission of the Zoo.

Advance accessibility on the Zoo site.

Create various opportunities for new audiences to connect with and support the new mission and to increase revenue and attendance.

Increase earned revenue through the creation of new experiences and programs.

Develop a strong partnership with the Rouge National Urban Park.

Develop other strategic alliances using a diverse platform of conservation actions and stewardship programs.

Establish compelling opportunities for partners, sponsors and donors to support wildlife and habitats in our priority areas and our conservation focus.

Provide learning and development programs that meet the identified needs of staff and volunteers to allow us to excel in our roles.

Assess the Toronto Zoo brand and re-position to align with the new mission, vision and goals.

Through school and education programs, inspire current and future generations to become active stewards of wildlife conservation.

PRINCIPLES

Moving towards the future, the Toronto Zoo's Master Plan will enable the Zoo to continue to build upon the many successes of the last 42 years while concentrating on key directives of the Strategic Plan, namely focusing on the care, conservation and interpretation of Canadian animals and habitats while also nurturing a sustainable diversity of the world's wildlife and their attendant learning opportunities; advancing accessibility and the ability of the Zoo to meet the needs of Toronto's diverse residents; and creating a zoo-based conservation centre of excellence that can achieve tangible conservation outcomes on a number of inter-related fronts.

The Master Plan has been informed by the Strategic Plan, the Zoo's mission, its physical setting and the nature of the animals in its care, as well as a thorough understanding of international trends in zoo design. In addition, the Plan relies heavily on an understanding of the evolving market forces in Toronto and the world at large in order to continue to deliver meaningful experiences of discovery and learning for the region's changing families.

The goal of the Master Plan is to provide a capital improvements and program road map for the people and the organization to use in carrying out the goals and objectives of the Strategic Plan. The net outcomes of all of these efforts can be concisely summarized as follows (and as shown in the Strategic Intent Diagram):

- Tangible Conservation Outcomes
- Excellent Care of Our Animals
- Inspiring Guest Experiences & Learning Opportunities
- **Financial Sustainability**

The transformation envisioned in the Master Plan can be summed up in the following series of principles:

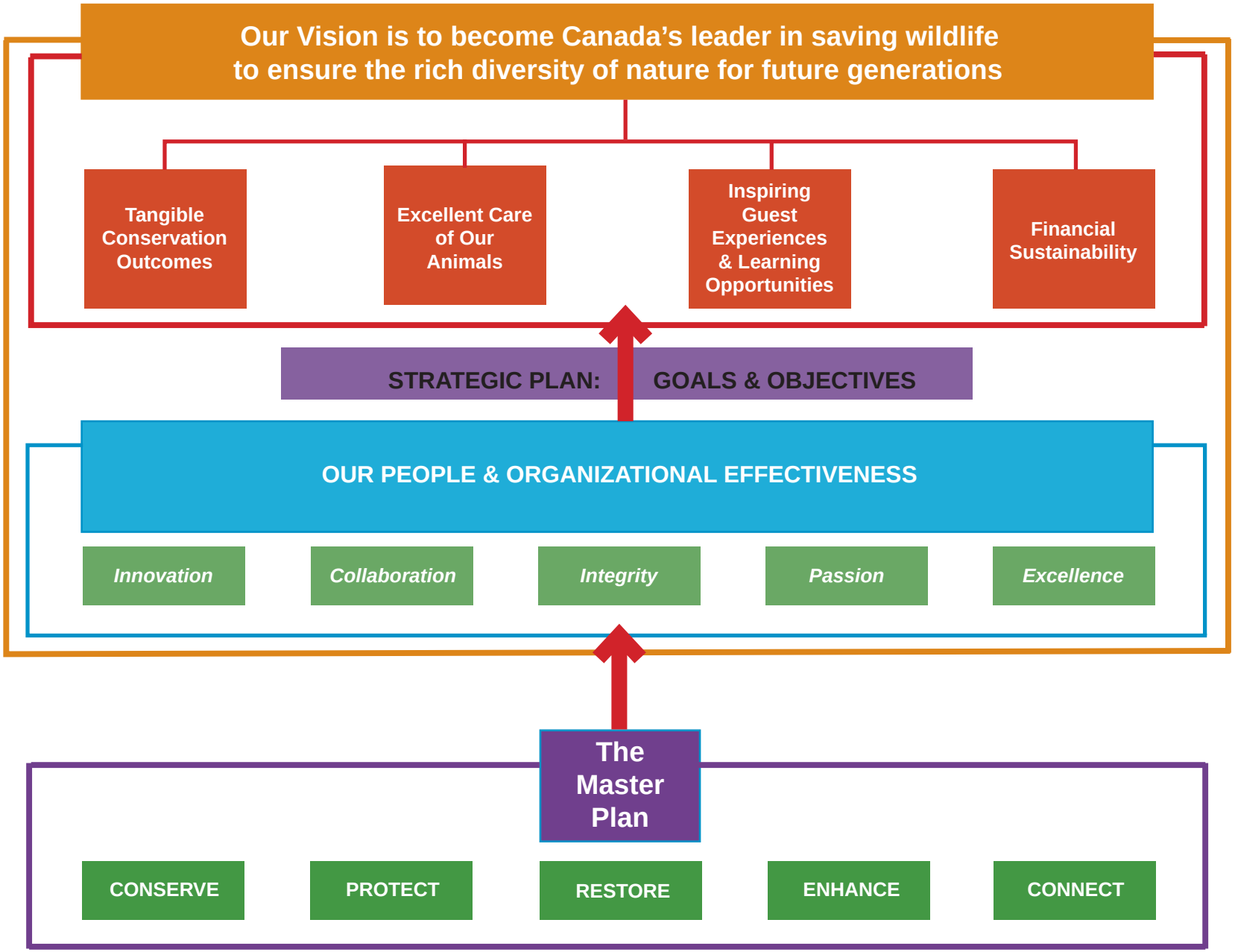
- Conserve
- Protect
- Restore
- Enhance
- Connect

These principles, more fully described below, tie the Master Plan back to the Strategic Plan through an overarching vision and action plan of CARE: Care for the animals | Care for the guests | Care for the environment | Care for Staff and the institution.

Conserve essential Ecosystem Characteristics

Conservation is the primary function of what the Zoo does. It will conserve wildlife in wild places and inspire the community to understand and value wildlife and their habitats.

It will be recognized as the preeminent public park in Toronto rooted in a mission of conservation. Specific outcomes for biodiversity and ecosystem health will be established and tied to achievable targets that will be established and monitored throughout all areas of the Toronto Zoo.


Our Vision is to become Canada's leader in saving wildlife to ensure the rich diversity of nature for future generations
Tangible Conservation Outcomes
Excellent Care of Our Animals
Inspiring Guest Experiences & Learning Opportunities
Financial Sustainability
STRATEGIC PLAN:
GOALS & OBJECTIVES
OUR PEOPLE & ORGANIZATIONAL EFFECTIVENESS
Innovation
Collaboration
Integrity
Passion
Excellence
The Master Plan
CONSERVE
PROTECT
RESTORE
ENHANCE
CONNECT

Protect sensitive Habitat and Animal Welfare

Animal welfare is fundamental and the Zoo will manage and care for animals and habitat exceptionally. Ensure that all exhibits and upgrades are appropriate for the species and confirm this with up-to date science-based advice.

Sensitive habitats will be identified and designated for user experiences of research and conservation supplemented with interpretive signage. These will include Areas of Natural and Scientific Interest (ANSI's) and identified species at risk habitat.

Consult scientific information available in other zoological institutions and academia. Consider multi exhibits for species such as social carnivores to allow for separation of animals as required for ensuring their welfare. Ensure that the animals' physical and psychological needs are met. Provide choice of access to the natural elements as well as natural change and environmental challenge that encourages curiosity and engagement. Ensure that staff members can safely and easily engage in maintenance, care and training, which enables animals to lead rich and fulfilling lives without undue stress or injury.

Restore the Waterways and Natural Forest Habitat

The waterways, wetlands and natural forest habitat will be restored to a level of ecosystem health that is appropriate to a conservation-based institution. User experience of these domains will include all the permitted uses in the sensitive habitat plus foot paths, trails and other low-impact human use.

Enhance the interface between Animal Habitats, Programs and Guest Experiences

The Zoo will provide a series of programmed and free-choice experiences and site based learning opportunities. It will accommodate opportunities for relaxed enjoyment as well as active engagement. The circulation system will be adaptive, flexible and fully accessible.

Connect People to Nature

The Zoo will maintain the highest quality visitor experience to connect visitors with animals, staff and mission. The Zoo will also connect its conservation work with the values and aspirations of the community by establishing a sensible plan that provides strategic and well-orchestrated investment over time.

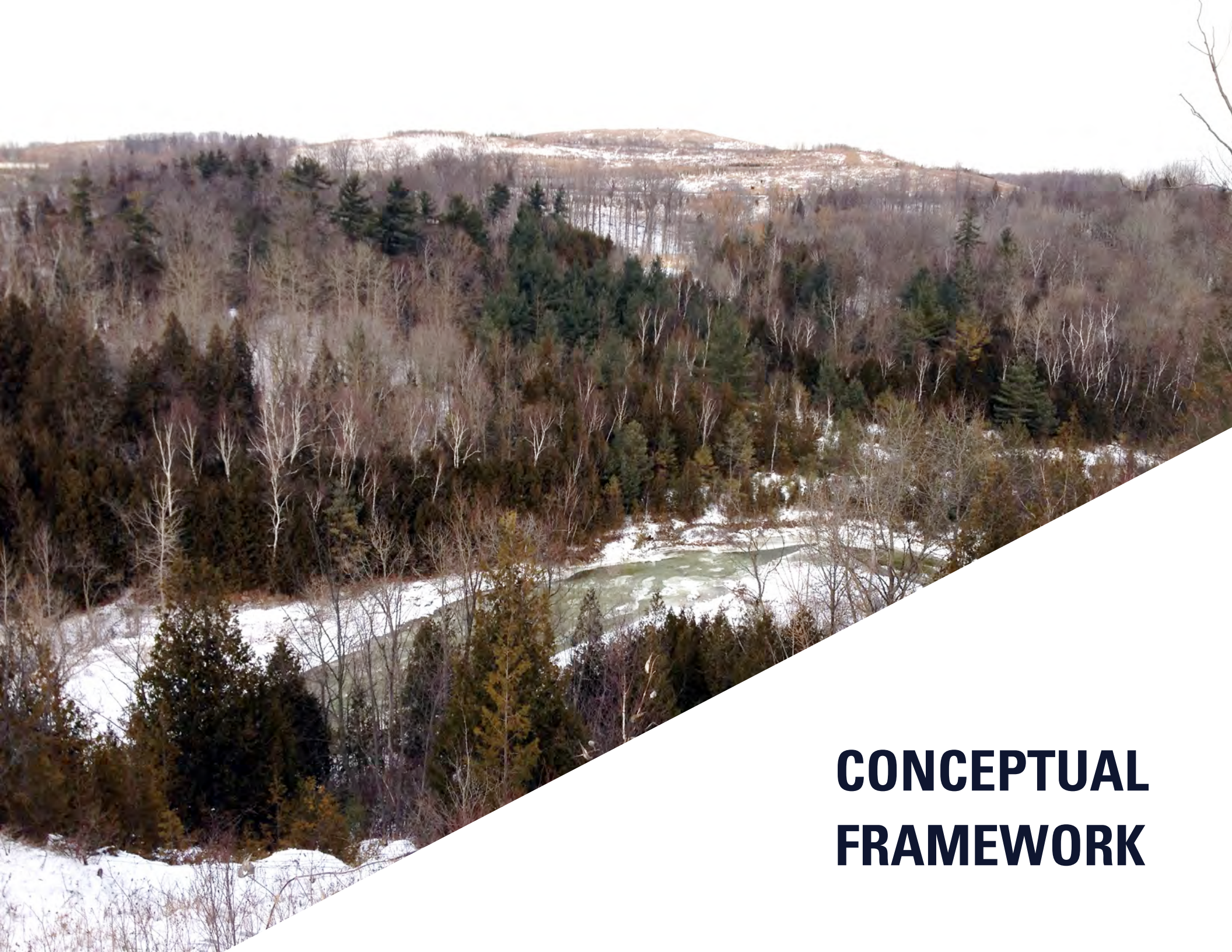
The Zoo will connect with surrounding neighbourhoods, Rouge National Urban Park and the City. The Master Plan identifies opportunities for improved pedestrian connections from the Rouge National Urban Park and adjacent municipal infrastructure.

Improved bicycle and transit access that links the Zoo to existing municipal infrastructure is critical.

A Mobility Management Committee (MMC) should be created comprised of the Toronto Zoo, Rouge National Urban Park, University of Toronto Scarborough Campus, Centennial College and others to communicate about upcoming events and coordinate the variety of activities and festivals that the Zoo and others will mount.

The MMC should coordinate shuttle services and bike share opportunities at municipal transit stops, the Rouge National Urban Park and other points of origin and destinations.

Dendrobates azureus - Blue Poison Dart Frog



CONCEPTUAL FRAMEWORK

A STRONG FOUNDATION FOR CHANGE

Recent planning at the Toronto Zoo has enabled the Zoo to coalesce and condense some of the more far-flung exhibits and public experiences, and to clarify and simplify the service and pedestrian circulation systems. This Master Plan is designed to continue to build upon these earlier endeavours with specific areas of added emphasis, including:

- Clarify the story and main messages of the Toronto Zoo.
- Clarify the nature and extent of major animal habitat and experience zones.
- Further develop clear pedestrian circulation systems that are fully accessible and able to be expanded or contracted, depending on the weather.
- Resolve the Zoo entry and access issues to provide a smooth functioning and delightful experience for all.
- Incorporate "hot spots" throughout the Zoo to provide ample opportunity for Discovery and Learning staff to engage with guests via informal presentations. Such spots should also contain ample opportunity for seating and relaxation for adults, as well as "nature play" for kids.
- Recommend further revenue generation opportunities that are in keeping with the natural character, style and messaging of the Zoo.
- Build upon opportunities provided by the adjacency of the Rouge National Urban Park.
- Enable exceptional animal care, welfare and breeding programs, including providing the highest quality, flexible animal spaces and enrichment opportunities.
- Provide facilities that enable staff to function at the highest level of efficacy, safety and professionalism.
- The Toronto Zoo and Parks Canada jointly entered into a process to assess joint needs and opportunities for the future in terms of a shared educational and visitor orientation facility. The facility would provide a much-needed venue to fulfill each organization's requirement for education, conservation, and establishing a connection to nature for individuals, community and school groups, and residents.

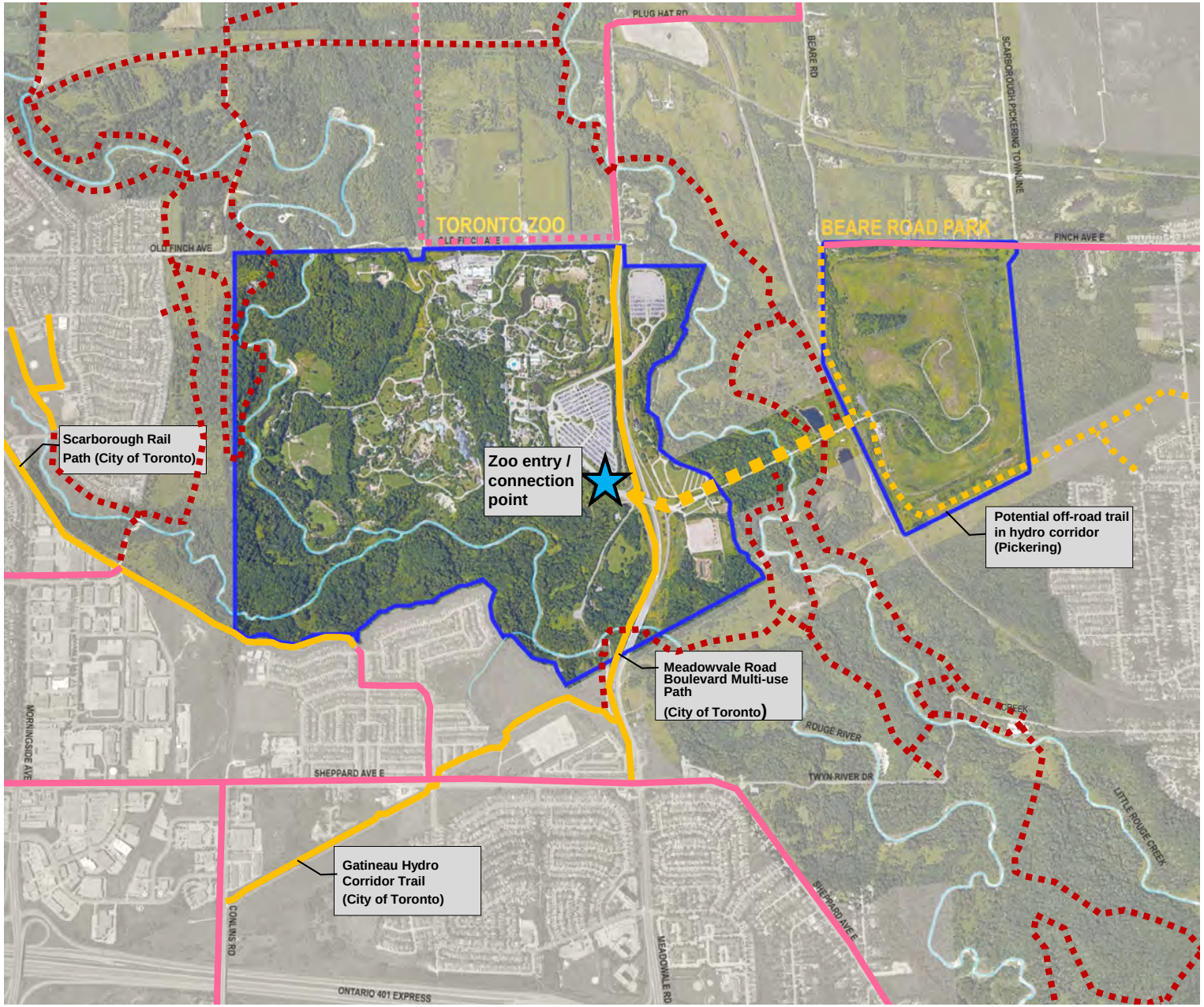
Conservation and Care, Toronto Zoo

Nature Play and Discovery

Wildlife Health Centre

Legend

- Existing Off-road Multi-use Trail
- Potential Off-road Multi-use Trail
- On-road Cycling Route (from approved municipal master plan)
- Potential On-road Cycling Route (not currently part of municipal master plan)
- Existing Trails and Possible Opportunities
- Access Route



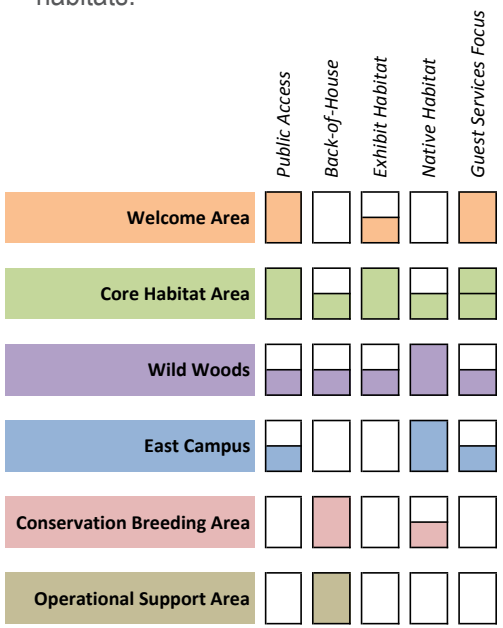
CONNECTIONS PLAN FIGURE 4

Existing Condition

SUMMARY OF THE MASTER PLAN

The Zoo site has been divided into six focal areas that are differentiated on the basis of the following:

- The level of public access versus back-of-house operations;
- The degree of observable exhibit habitat for animals in our care versus free-range habitat for at-large native species;
- The focus on guest services versus animal habitats.



Each area exists essentially independently of the others while being tied together by a carefully choreographed circulation system that enables them all to act in support of the Zoo's mission and vision.

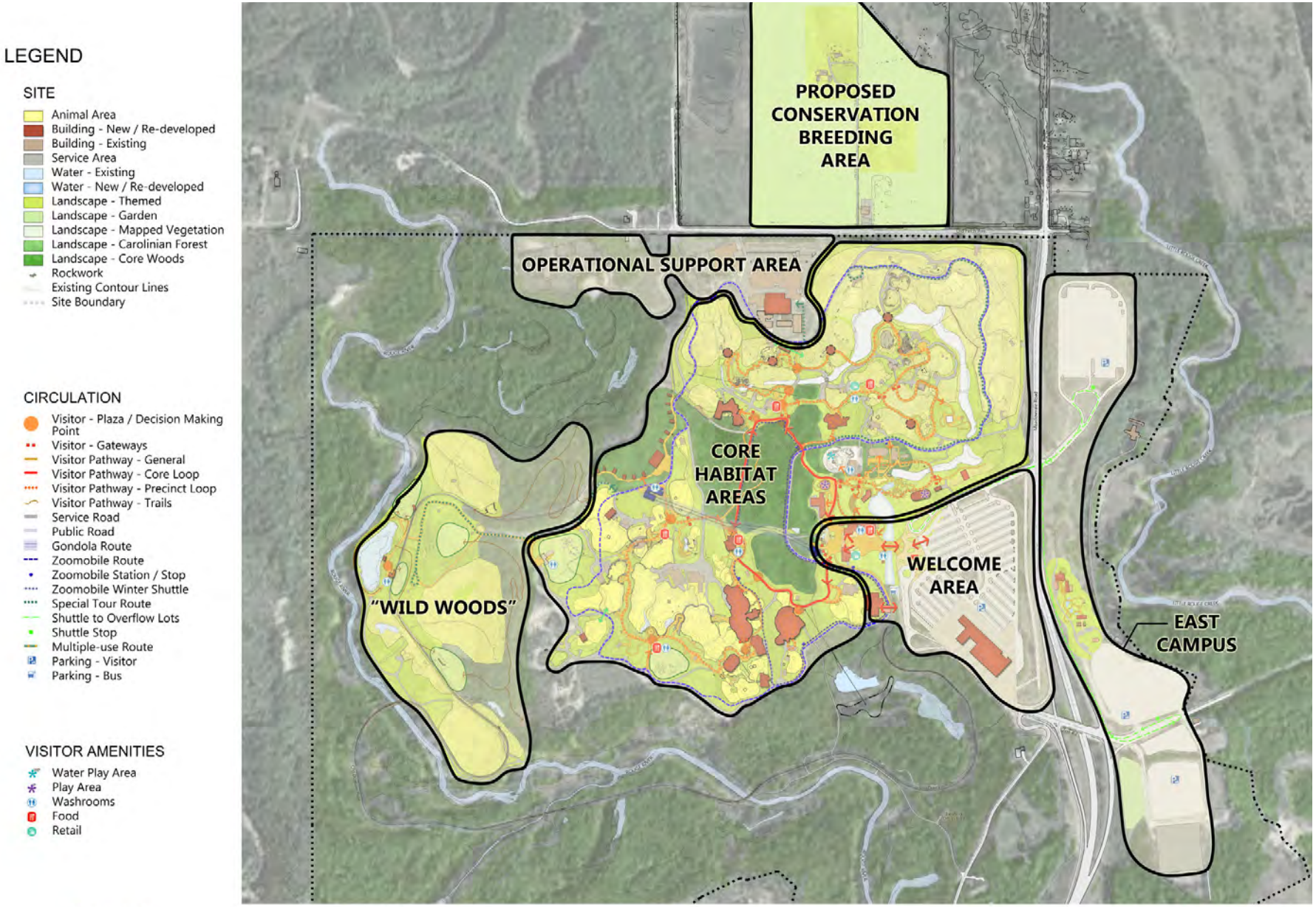
These areas include the following:

- Welcome Area: The Zoo's front door.
- Core Habitat Area: The prime visitor experience and learning landscape.
- Wild Woods:
  An area set aside for guided group experiences, learning activities within the Zoo's Rouge River landscape.
- East Campus:
  Remote parking and opportunities for a festival area and lodging to support a better integration with the Rouge National Urban Park.
- Conservation Breeding Area:
  An off-public-view area for the Zoo's conservation breeding programs, as well as support for the Zoo's existing animal populations.
- Operational Support Area:
  Back-of-house maintenance, operations and administration areas required for the Zoo's smooth functioning.

The Master Plan will enhance and restore significant habitat for local and regional wildlife, provide camping and outdoor trails as well as improve the connectivity of the Zoo to neighbouring wildlife and urban systems. Opportunities exist for a boutique lodge and destination restaurant to be developed in partnership with the private sector. The existing arrival and entrance spaces will be redeveloped with a design approach that will introduce visitors to a reinvigorated public space that showcases living systems approaches to infrastructure shared Toronto Zoo / Rouge Park education / orientation facility. Sustainable food systems will be incorporated into the restaurant brand and together these publicly accessible amenities will provide a redesigned introduction and welcome to the Zoo.

The reimagined Welcome Area in conjunction with the East Campus Area on the tableland east of Meadowvale Road that overlooks the Little Rouge River will enhance the reputation of the Zoo in the local community who provide partnership and revenue opportunities outside of the pay-per-use experience of the Core Habitat Area.

Each of these six areas are comprised of several Zones, that are described in the following pages.


LEGEND
SITE
Animal Area
Building - New / Re-developed
Building - Existing
Service Area
Water - Existing
Water - New / Re-developed
Landscape - Themed
Landscape - Garden
Landscape - Mapped Vegetation
Landscape - Carolinian Forest
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Rockwork
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Site Boundary
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Multiple-use Route
Parking - Visitor
Parking - Bus
VISITOR AMENITIES
Water Play Area
Play Area
Washrooms
Food
Retail
PROPOSED CONSERVATION BREEDING AREA
OPERATIONAL SUPPORT AREA
CORE HABITAT AREAS
"WILD WOODS"
WELCOME AREA
EAST CAMPUS
toronto ZOO
Master Plan - Zoo Focal Areas
Toronto Zoo Master Plan
November 2016
MMM GROUP

FIGURE 5

FOCAL AREAS OF THE MASTER PLAN

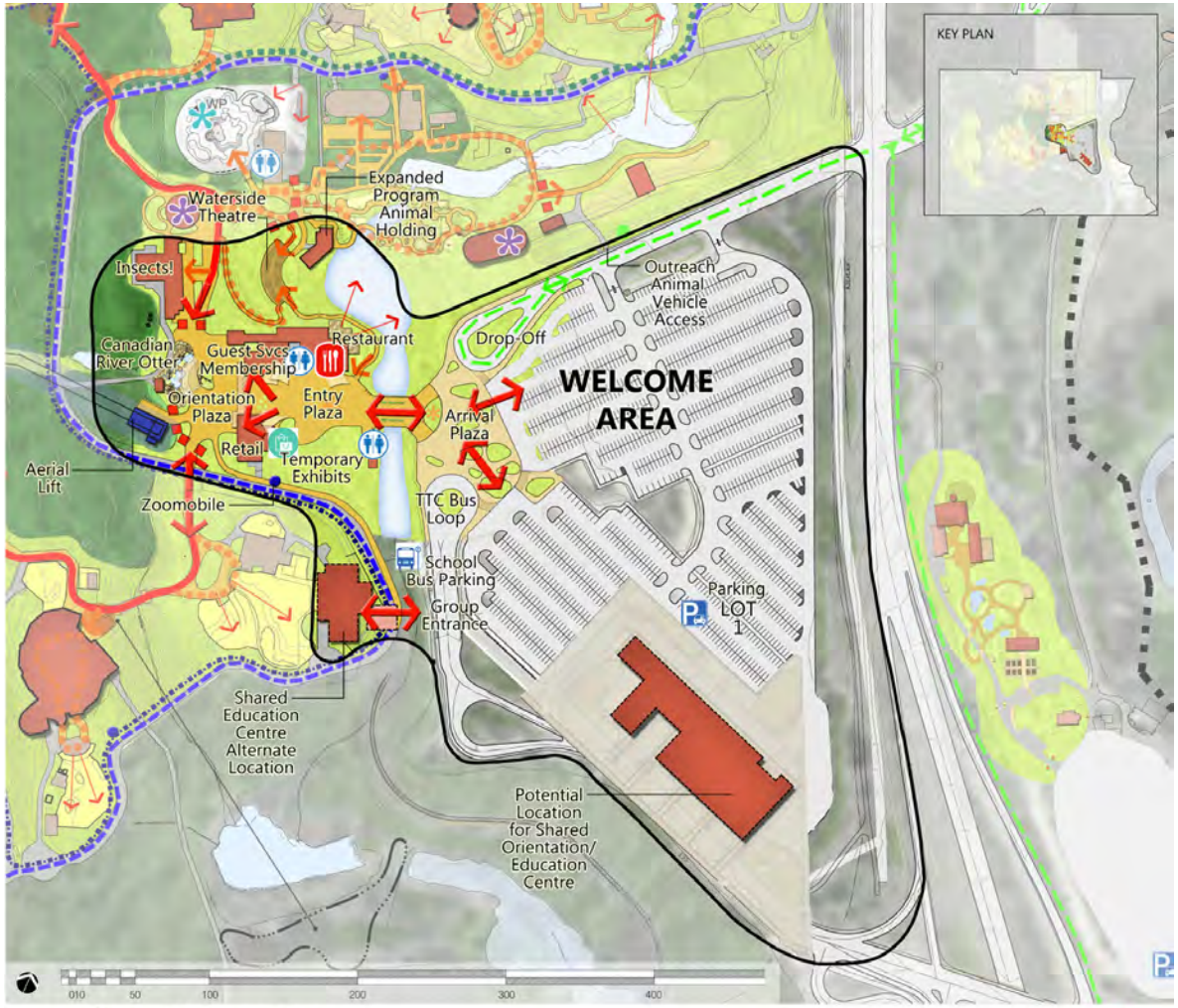
WELCOME AREA

The Welcome Area is set up to provide essential guest services to both Zoo visitors and visitors to the adjacent Rouge National Urban Park. It is an area where functionality matters, as well as the quality of the experience, because it is the first and last “touch point” for guest engagement with both facilities and, as such, is the prime locale for expressing the Zoo’s mission and evincing the over-riding principle of CARE that has informed the development of the physical Master Plan.

Guests’ first experience of the Welcome Area is in the Parking Area, an area of coming and going and getting ready. Parking will continue to be handled within the main lot, as well as a series of remote, overflow lots that will be linked to the Arrival Plaza by a ZooTram that runs during peak visitation periods. This will ensure that, regardless of the final destination, visitors can gain easy access to the front doors of both the Zoo and the Park, as well as the refreshments and education facilities that lie in close proximity to the Zoo’s entry.

Additional areas of the Welcome Area include:

- Arrival Plaza
- **Entry Plaza**
- Orientation Plaza



Master Plan - Welcome Area
Toronto Zoo Master Plan
November 2016

FIGURE 6

toronto ZOO

Zoo Welcome Area

Toronto Zoo Master Plan

SCALE = 1:300 AT ARCH E

0 10 20 30 40 50 M

November 2016

MMM GROUP

FIGURE 7

ARRIVAL / DEPARTURE PLAZA

The Arrival Plaza is the main meeting place for people coming together out of their individual cars and public transportation vehicles, and taking on the communal role of “Zoo guest”. It is a place that is firmly rooted in the surrounding Ontario landscape, and channels visitors effortlessly and graciously to and from the Entry Plaza.

Drop-off will be provided for regularly scheduled Toronto Transit Commission (TTC) bus service, as well as school buses and personal vehicles that includes the following:

- Convenient drop-off close to the Entry Plaza and Group Entry of the Zoo for private cars, public transportation and school buses.
- Waiting and pick-up areas for parent/guardians of children attending Zoo programs.
- Zoo Shuttle to overflow parking lots, and between the Zoo and Park entry during peak periods.
- Easy access for pick-up and drop-off of Zoo outreach animals from the Kids Zoo back of house.

Toronto Zoo Welcome Area

ENTRY PLAZA

The Entry Plaza will operate as a “free campus” where visitors can arrive, make decisions about their day at the Zoo, purchase tickets, seek information and regroup prior to passing through the ticketed perimeter of the Zoo. Ticket sales and ticket-taking will continue to be further automated over time, but guests will always be able to count on a friendly face to welcome them.

The facilities that will be freely available include washrooms, ticket sales and information, a restaurant/café with an outdoor deck overlooking the lake and a second floor rentable event centre, gift shop and rental facilities, and a central iconic sculpture / gathering area.

Toronto Zoo Otter Display

ORIENTATION PLAZA

The Orientation Plaza lies just beyond the ticket-taking gateway and becomes a prime decision-making point for determining how visitors will start their day at the Zoo. As in all aspects of the Welcome Area, experience is critical and a lack of commercial clutter will reinforce the quality and commitment to the conservation efforts of the Zoo. A Canadian river otter family acts as the welcoming icon and, in concert with Zoo volunteers and guides, provides guests with the breathing space to start their journey.

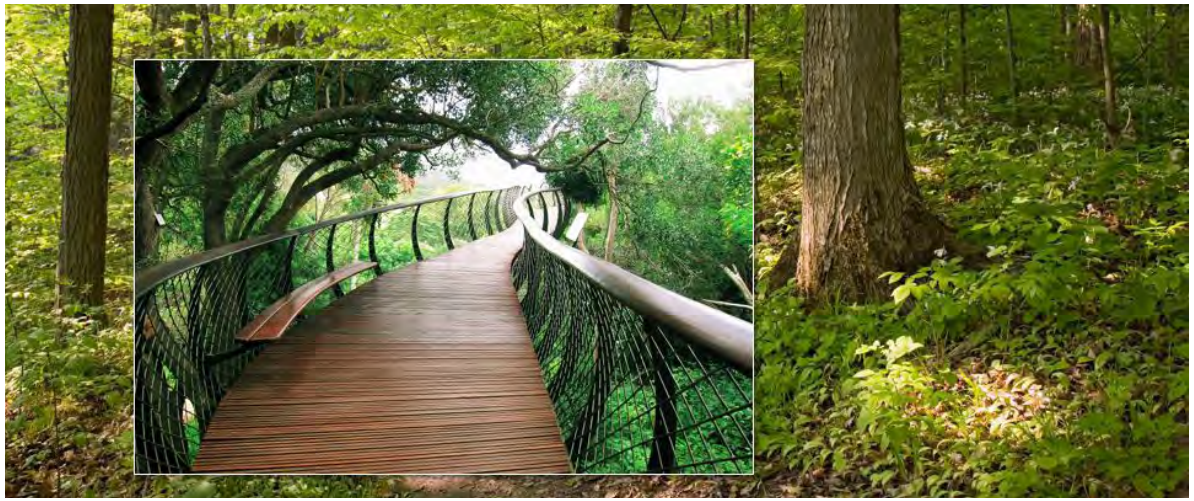
At this point, visitors will have the option to continue on their walking journey around the Zoo, choose to board the Zoomobile for an introductory tour or access to more remote parts of the site, or avail themselves of an aerial tram that offers a shortcut to and from the upper ridge animal habitats. In the winter, the Zoomobile will offer a shorter trip through the core of the Zoo that enables visitors to quickly get to the Zoo’s indoor pavilions or to visit the Canadian animals in their outdoor habitats.

Toronto Zoo Orientation Plaza

CORE HABITAT AREA

- Across the Equator
- Wilderness North
- Tropical Americas
- Carolinian Forest
- **Discovery Zone**

The Zoo's core habitats will continue to be refined, defined, blended and merged in concert with the Zoo's commitment to animal and visitor well-being. The goal will be to condense the walk but not the visitor experience to provide a series of 20-30 minute loops that can be linked together as a linear sequence for first-time visitors, or as a series of free-choice experiences to visit "old friends" by repeat visitors and members. Such intensive experiences and site-based learning opportunities will be supplemented by generous shelter, shade rest, relaxation and refreshment options, as well as 'natural play' spots to encourage visitors to unhurriedly enjoy their time.



Proposed Thematic Experiences

The experience loops will be comprised of primarily zoogeographic, immersive habitats (animals from similar geographic regions: African Savanna, etc.) that provide unique opportunities to Torontonians to the wealth of species in the tropical and temperate regions where the Zoo is actively engaged in situ and ex situ conservation work. In addition to being able to get up-close and observe animals in natural surroundings and dynamic social groupings, visitors will be able to learn more about the natural and human history that has brought us to "The Present", as well as personal stories, science and conservation activities, and policy work that is aimed at working together to save species from extinction.

The Zoo has extensive experience in caring for a range of animals with either a minimum of shelter (cold-adapted), or that require summer/winter ameliorations similar to those that make us comfortable.

Recognizing that we need to meet and exceed evolving animal care standards and guest expectations, it is intended that priority planning and phasing of habitat renovations and additions will remain flexible.

LEGEND

SITE

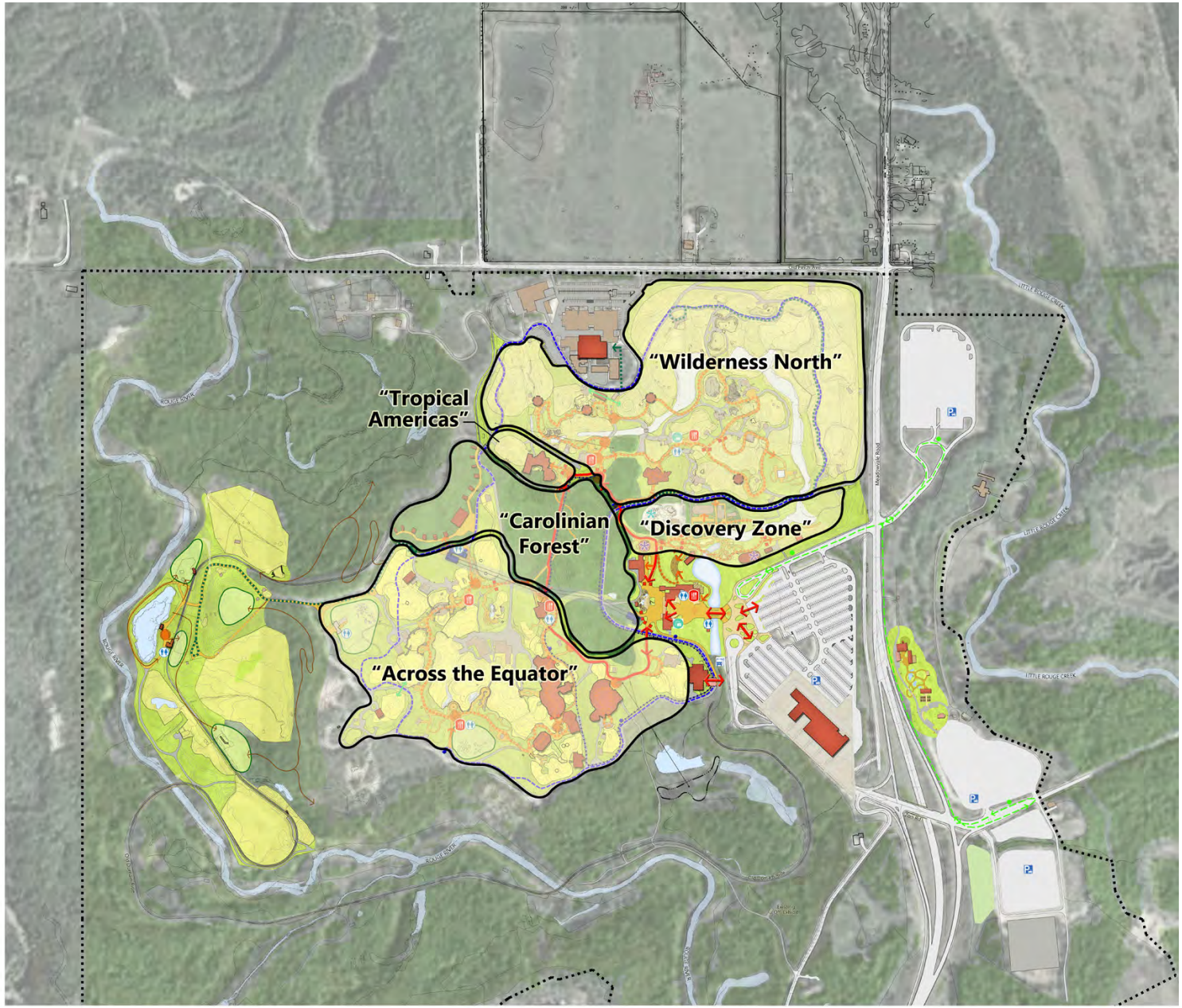
- Animal Area
- Building - New / Re-developed
- Building - Existing
- Service Area
- Water - Existing
- Water - New / Re-developed
- Landscape - Themed
- Landscape - Garden
- Landscape - Mapped Vegetation
- Landscape - Carolinian Forest
- Landscape - Core Woods
- Rockwork
- Existing Contour Lines
- Site Boundary

CIRCULATION

- Visitor - Plaza / Decision Making Point
- Visitor - Gateways
- Visitor Pathway - General
- Visitor Pathway - Core Loop
- Visitor Pathway - Precinct Loop
- Visitor Pathway - Trails
- Service Road
- Public Road
- Gondola Route
- Zoomobile Route
- Zoomobile Station / Stop
- Zoomobile Winter Shuttle
- Special Tour Route
- Shuttle to Overflow Lots
- Shuttle Stop
- Multiple-use Route
- Parking - Visitor
- Parking - Bus

VISITOR AMENITIES

- Water Play Area
- Play Area
- Washrooms
- Food
- Retail



toronto ZOO

Master Plan - Core Habitat Area

Toronto Zoo Master Plan

SCALE = 1:2500 at Arch E

0 10 50 100 200 300 400 500

MMM GROUP

November 2016

FIGURE 8

ACROSS THE EQUATOR

The southern portion of the Zoo's core habitat will maintain its focus on animals and habitats from warmer climates. Originally envisioned as focusing exclusively on the African Savanna and Indo-Malaya regions, the Master Plan envisions a broader definition of the latter to include all of the Oceania region so that the Zoo is better able to represent the animals and conservation activities of the Australasian as well and the Indo-Malayan region. In addition, the Savanna has been renamed "Pridelands" to reflect the enhanced stature of the Lion habitat and interpretation of the role of carnivores in maintaining the health of the herds and the landscape.

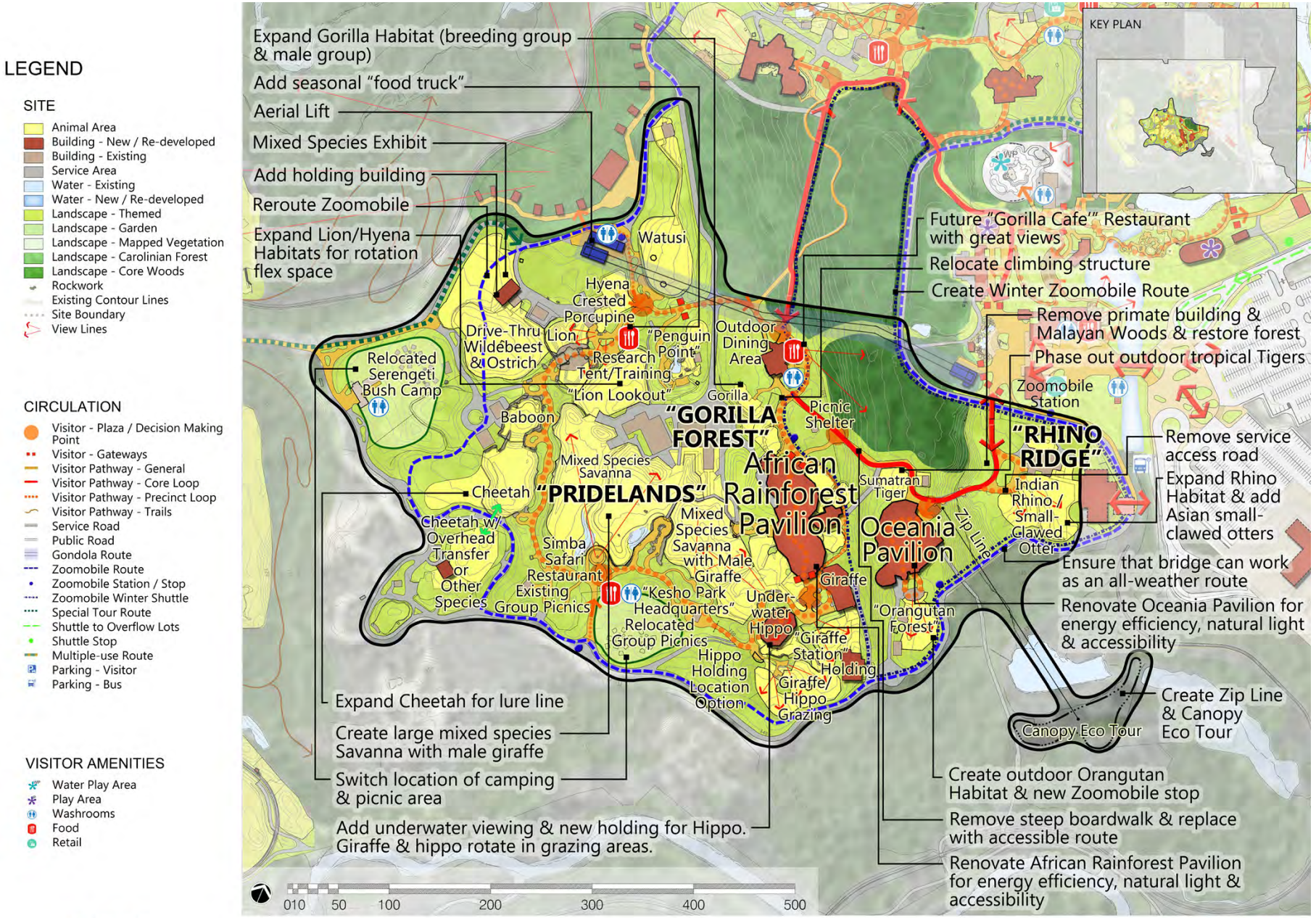
Renovations in both will include enlargement of selected habitat areas, the development of mixed species areas as appropriate, rotational exhibits to provide more overall space and enrichment for carnivores, back-of-house improvements, and accessibility and facility upgrade improvements.

The renovation of the two 1970's-era Ron Thom pavilions are of particular interest: each requires substantial improvements to infrastructure to bring the buildings up to energy and accessibility code while, at the same time, providing more indoor space and choice for a core group of animals. It is envisioned that the provision of more light for animals and plants plus better insulation values can be accomplished through the retro-fitting of the roof structure with a multi-layered ETFE membrane while maintaining the same structural approach and building aesthetics.

Rebuilding of the Indo-Malaya ramp will enable easy and direct access from the Pavilion to the ridgeline above where the African Rainforest Pavilion sits.

The creation of a winter tram circulation route that links together the Zoo's major pavilions and utilizes the service bridge as a year-round route will enable the Zoo to care for and better cater to its winter visitors, providing them with a condensed experience with animals in a close-in experience. It is envisioned that the bridge can be kept as a serviceable part of the circulation system through the use of regular applications of a calcium magnesium acetate or through the use of hydronic or electrical heat sources.

Ancillary buildings that no longer serve the needs of the animals, staff or visitors will be removed (Macaque building and "Malayan Woods"), thus allowing the edges of the existing ravine to be restored to enable the Carolinian Forest to continue to flow through the Zoo.



Master Plan - "Across the Equator"

Toronto Zoo Master Plan

November 2016

FIGURE 9

"African Rainforest" Pavilion

The African Rainforest Pavilion demonstrates the rich biodiversity of this region, from terrestrial iconic species through the aquatic ecosystems that this region depends on. The focal species for this pavilion will highlight threats to the imperiled wildlife that rely on this critical habitat. The themes of this pavilion will draw attention to the extent of the Zoo's involvement in conservation projects in this part of the world.

"Oceania" Pavilion

The reinvented Oceania Pavilion will focus not just on Indo-Malayan species but also on other important areas of the South Pacific. This area will showcase the uniqueness of island flora and fauna, and will demonstrate the richness of these global biodiversity "hotspots", including Komodo dragon and key species relocated from the existing Australasia Pavilion.

"Rhino Ridge"

The existing Rhino habitat will be expanded to include more area, as well as a family of Asian small-clawed otters as part of a mixed species exhibit.

"Gorilla Forest"

The existing exterior Gorilla habitat will be redeveloped and expanded to provide an extensive landscape that offers choice, retreat and stimulation for the Zoo's resident family.

"Pridelands"

This area was renovated and expanded in 1998 and continues to work well for visitors in the summer months when animals are outside and the Simba Safari lodge is open.

Proposed improvements include:

- Development of a major mixed species savanna through the consolidation of several single-species habitats. The species would include white rhinos, gazelle, zebra and younger male giraffe that are extraneous to the family herd. Concurrent with this redevelopment is the expansion of back-of-house holding area to enable superior care, especially during the winter.
- Expansion of the cheetah habitat to provide space for demonstrating more natural behaviours.
- Expansion of the lion habitat to allow for a large social pride, as well as a bachelor group, and rotational space for hyaena.
- Development of an indoor-outdoor habitat for hippos and visitors with underwater viewing and rotational shared grazing area with the giraffe herd.
- Establishment of giraffe and lion areas as mid-winter end-point destinations to shrink the space that visitors believe is open – only to discover that there are no animals in the habitats and nothing is open.

Orangutan

Mixed Species Habitat, Emmen Zoo

WILDERNESS NORTH

"Tundra Trek", "Canadian Wilderness" & "Asian Highlands"

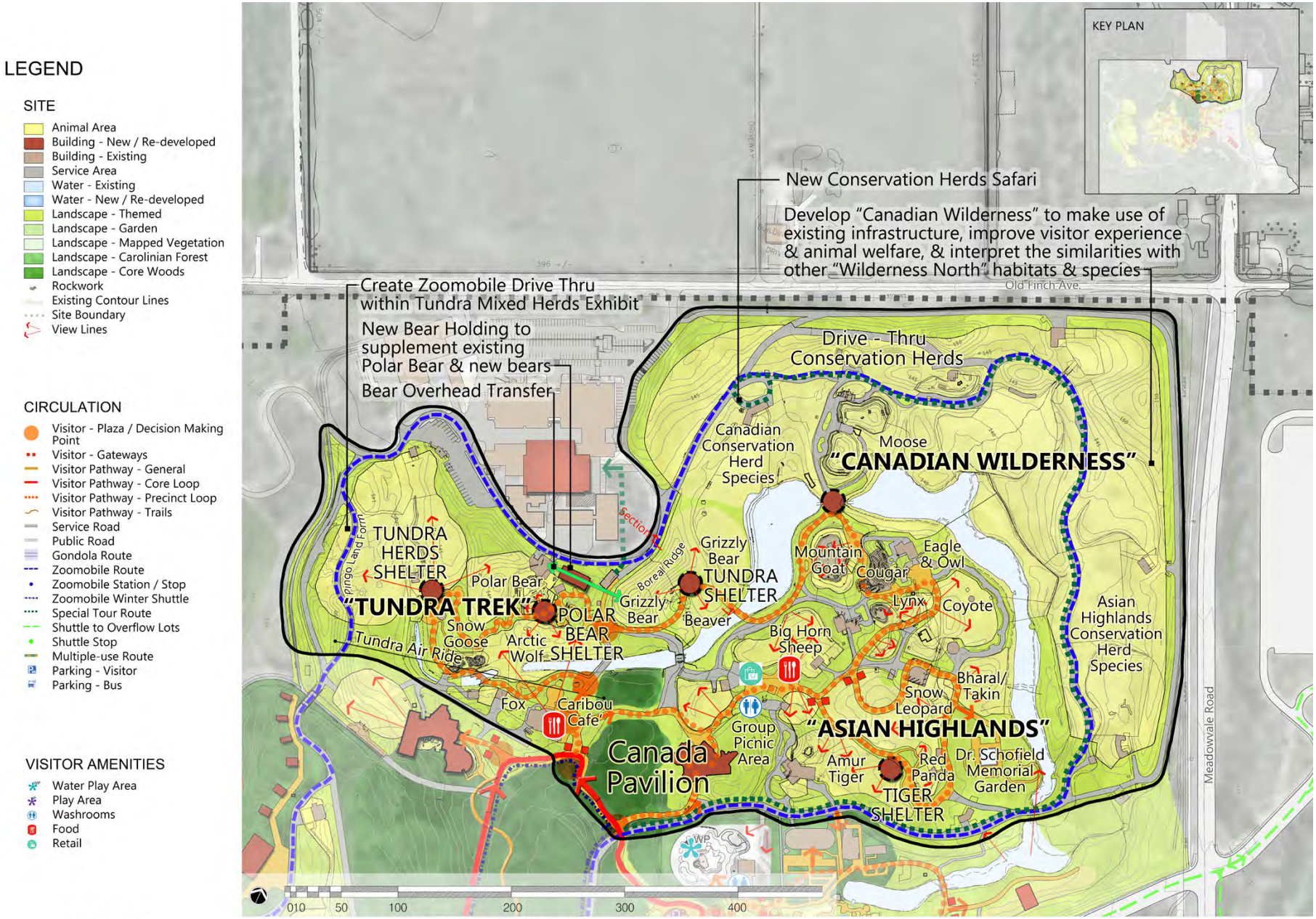
With the new Strategic Plan focusing on Canadian Species, the Toronto Zoo is launching Wilderness North Experience to enable more visitors to experience the vast diversity of species in their habitats native to Canada.

The northern portion of the Zoo will be renovated to accommodate the experience of all of the Canadian animals with a special subset that showcases comparative animals from the highlands of the Himalayas and Manchuria. Most of these animals will be supremely adapted to the Toronto climate and thus, the exhibits will be focused on the outdoors with warming structures to enable year-round use by visitors.

These separate destinations will be redeveloped as a coherent immersive experience that focuses on Canadian animals and their vulnerable counterparts from comparable boreal and high latitude/altitude regions of the Northern Hemisphere.

Proposed improvements include:

- Expansion of "Tundra Trek" to include more room for northern herd animals.
- Development of a Bear Centre that includes space for grizzlies and provides for greatly expanded space for the Polar bear by virtue of rotational exhibits and expanded holding for males.
- Drawing upon the CLR Plan for the "Canadian Wilderness", the former Eurasia area will be redeveloped to provide a denser, more visitor-friendly/animal welfare-focused home for the Zoo's Canadian, Manchurian and Himalayan species. There will be an additional weather-sheltered structure created that highlights the region's smaller species and celebrates the Zoo's conservation work on behalf of Northern species.
- Conservation herds will be maintained on the far side of the ponds, providing a rich visual backdrop, as well as an area for the Zoomobile tour and special excursion tours to encounter herds of animals.
- The purpose of the new 'Canada Pavilion' will be to draw attention to Canada's species at risk and highlight the many current and future conservation programs the Toronto Zoo is undertaking, with various strategic partners, to save these species. Some examples of these programs include many excellent cooperative efforts on the breeding and release of such species as the black-footed ferret, Blanding's turtle, Oregon spotted frog, Atlantic salmon, and eastern loggerhead shrike. With ever-changing and increasing threats to Canadian species, the focus of these programs will change and evolve to address needs as they arise.



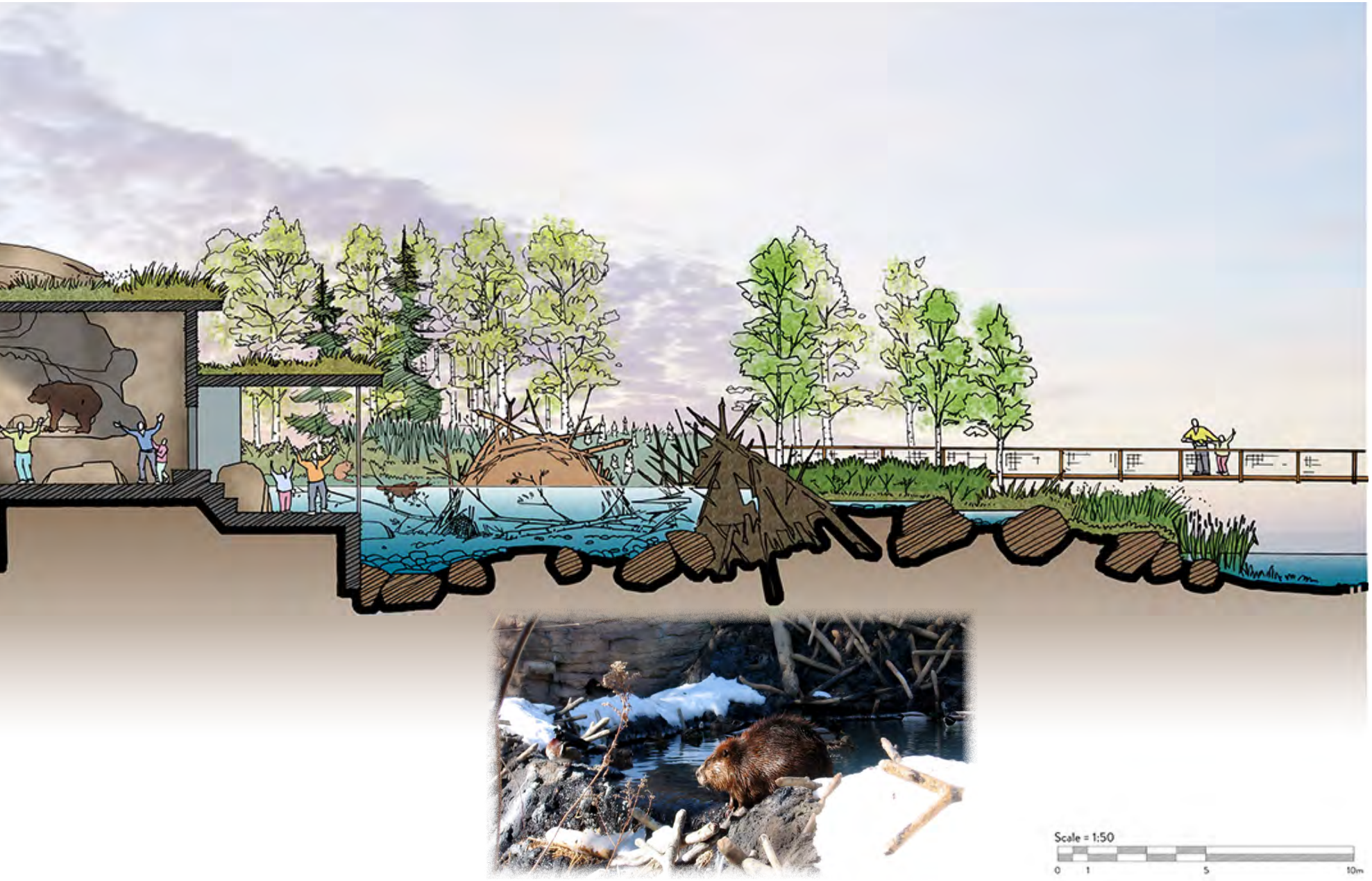
Master Plan - "Wilderness North"

Toronto Zoo Master Plan

November 2016

FIGURE 10

Ursus arctos ssp. - Grizzly Bear



Castor canadensis - North American Beaver

Canadian Wilderness Zone

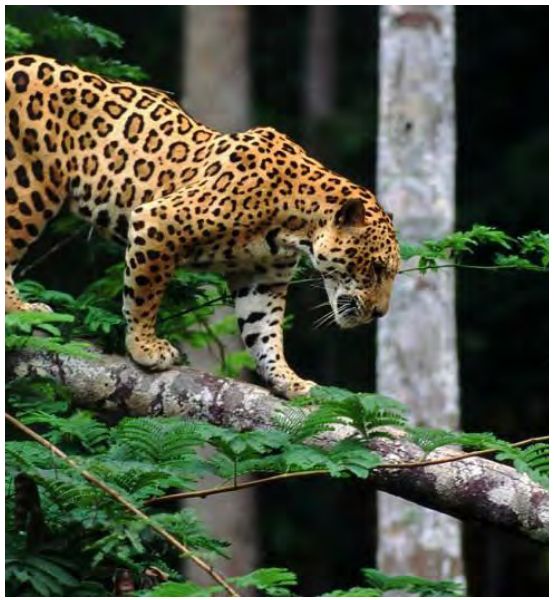
TROPICAL AMERICAS

The existing “Americas Pavilion” and exhibits will be renovated to provide full accessibility and address energy efficiency while also narrowing the focus of the interpretation and exhibits to highlight the species and conservation imperatives of tropical South and Central America, particularly those species that have an evolutionary or seasonal migratory relationship with Canada. It will act as another intriguing indoor space where visitors can come nose-to-nose with diverse animals of our world in a climate-mediated space.

Currently, the “Americas” exterior exhibits have been spread across a considerable distance that makes for a long walk in the heat of summer, and lack of animals to view in the winter. Equally many of these existing exhibits do not provide the animals with suitable stimulating environments, choice or the expression of habitat values. At a suitable point in the future, these exhibits will be phased out and redeveloped in closer proximity to the renovated “Tropical Americas Pavilion” once the adjacent “Tundra Trek” is expanded.

Animals to be included will be selected based upon conservation value, spatial needs and the Zoo’s ability to provide optimum care for them. Potential species could include tamarins and other small primates, jaguar, capybara, flamingo, reptiles, insects, rodents etc.

Leontopithecus rosalia - Golden Lion Tamarin



Panthera onca - Jaguar

Toronto Zoo Keeper with Parrot

LEGEND

SITE

- Animal Area
- Building - New / Re-developed
- Building - Existing
- Service Area
- Water - Existing
- Water - New / Re-developed
- Landscape - Themed
- Landscape - Garden
- Landscape - Mapped Vegetation
- Landscape - Carolinian Forest
- Landscape - Core Woods
- Rockwork
- Existing Contour Lines
- Site Boundary
- View Lines

CIRCULATION

- Visitor - Plaza / Decision Making Point
- Visitor - Gateways
- Visitor Pathway - General
- Visitor Pathway - Core Loop
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- Visitor Pathway - Trails
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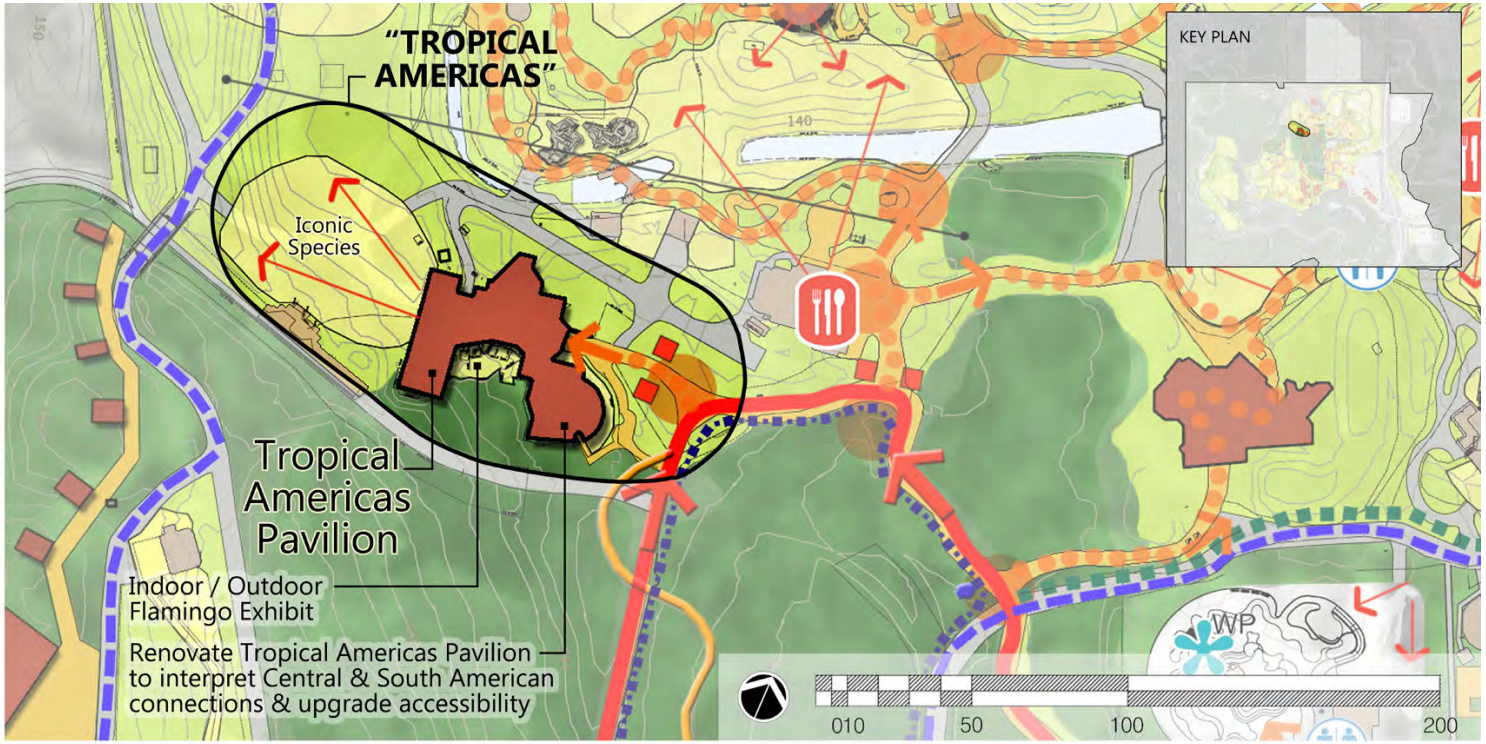
- Special Tour Route
- Shuttle to Overflow Lots
- Shuttle Stop
- Multiple-use Route
- Parking - Visitor
- Parking - Bus

VISITOR AMENITIES

- Water Play Area
- Play Area
- Washrooms
- Food
- Retail



Black-Handed Spider Monkey
Ateles geoffroyi

American flamingo
Phoenicopterus ruber

Capybara
Hydrocheorus hydrochaeris

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Master Plan - "Tropical Americas"

Toronto Zoo Master Plan

November 2016

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FIGURE 11

Americas Pavilion:
Future "Tropical Americas Pavilion"

The area around the existing Americas Pavilion is physically separated from both the "Pridelands" savanna habitats at the top of the hill as well as the adjacent "Tundra Trek" that will become part of the larger "Wilderness North" region. It would be difficult for it to act as a gateway experience to either area and will be considered on its own.

The building itself is interesting and can be renovated to be fully accessible. The protected indoor setting supports a renewed vision for the care, display and interpretation of smaller Australian and neo-tropical species. In this way, another intriguing area can be developed that provides critical indoor space for visitors, displays smaller species in an environment conducive to their welfare, and interprets the big changes that the Earth has undergone, and continues to undergo, giving perspective and context for current changes that are happening around us.

Phoenicopterus ruber - American Flamingos

Tropical Americas Pavilion

CAROLINIAN FOREST

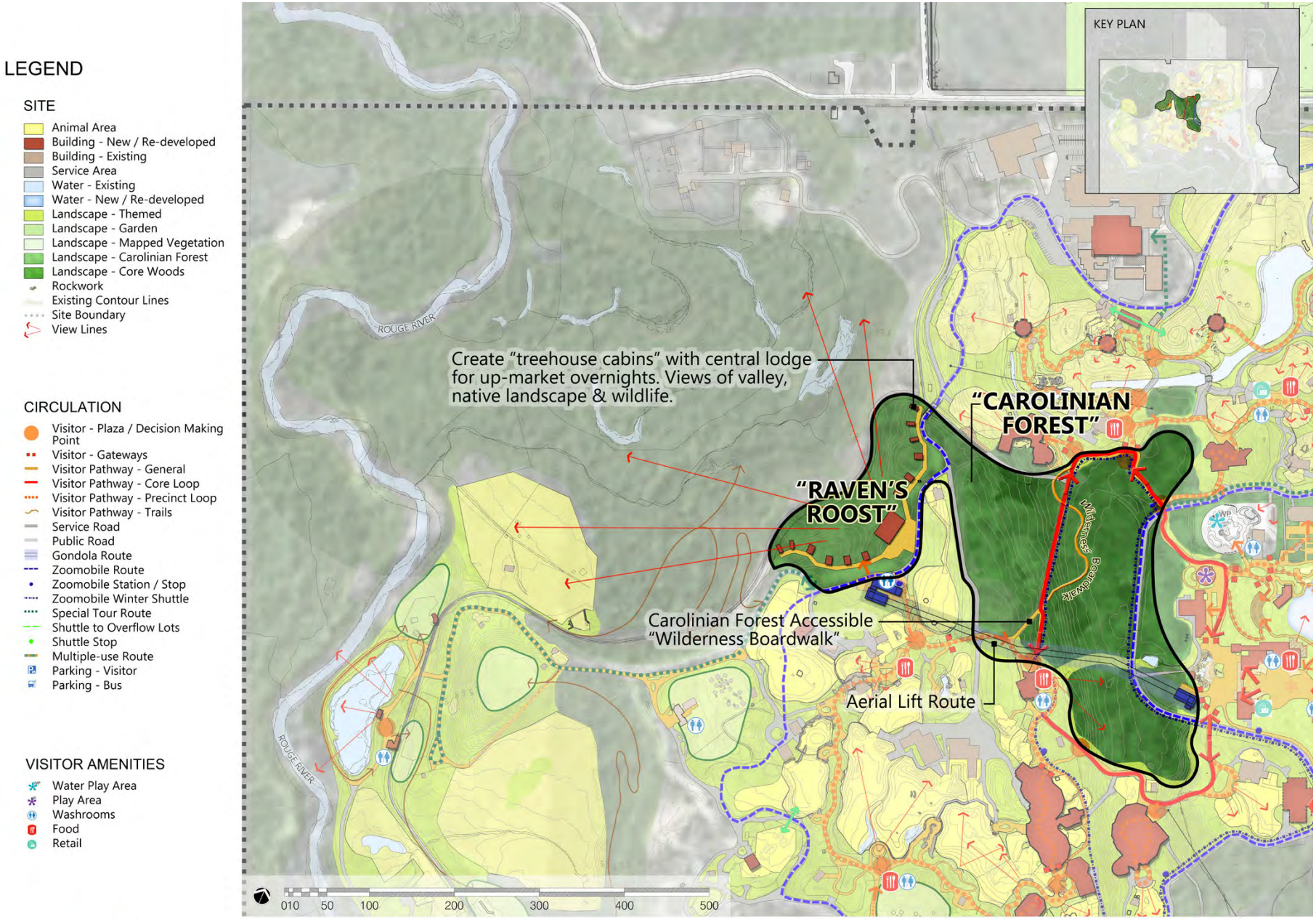
The central, native forest core of the Zoo provides an area of calm and quiet, and a place where the free-ranging plants and animals that make their home in the Rouge River valley make their presence felt to all Zoo visitors.

To maintain the integrity of the forest, development within this area will be limited to weed management, interpretation, pavement repair and the development of an "accessible 'boardwalk' that winds its way gently through the trees, support on strategically-placed pilings that do not disturb the integrity of the forest floor.

Raven's Roost

"Raven's Roost" is a natural extension of the Carolinian Forest experience. Sitting amongst the trees along the ridgeline overlooking the Rouge Valley, "Raven's Roost" will become a year-round family and small-group 'glamping' retreat where they can gather to relax and learn more about the dynamics of the surrounding natural environment and the work that the Zoo is doing to support wildlife both here and around the world.

Raven's Root - Overnight in the Trees



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Master Plan - "Carolinian Forest"

Toronto Zoo Master Plan

November 2016

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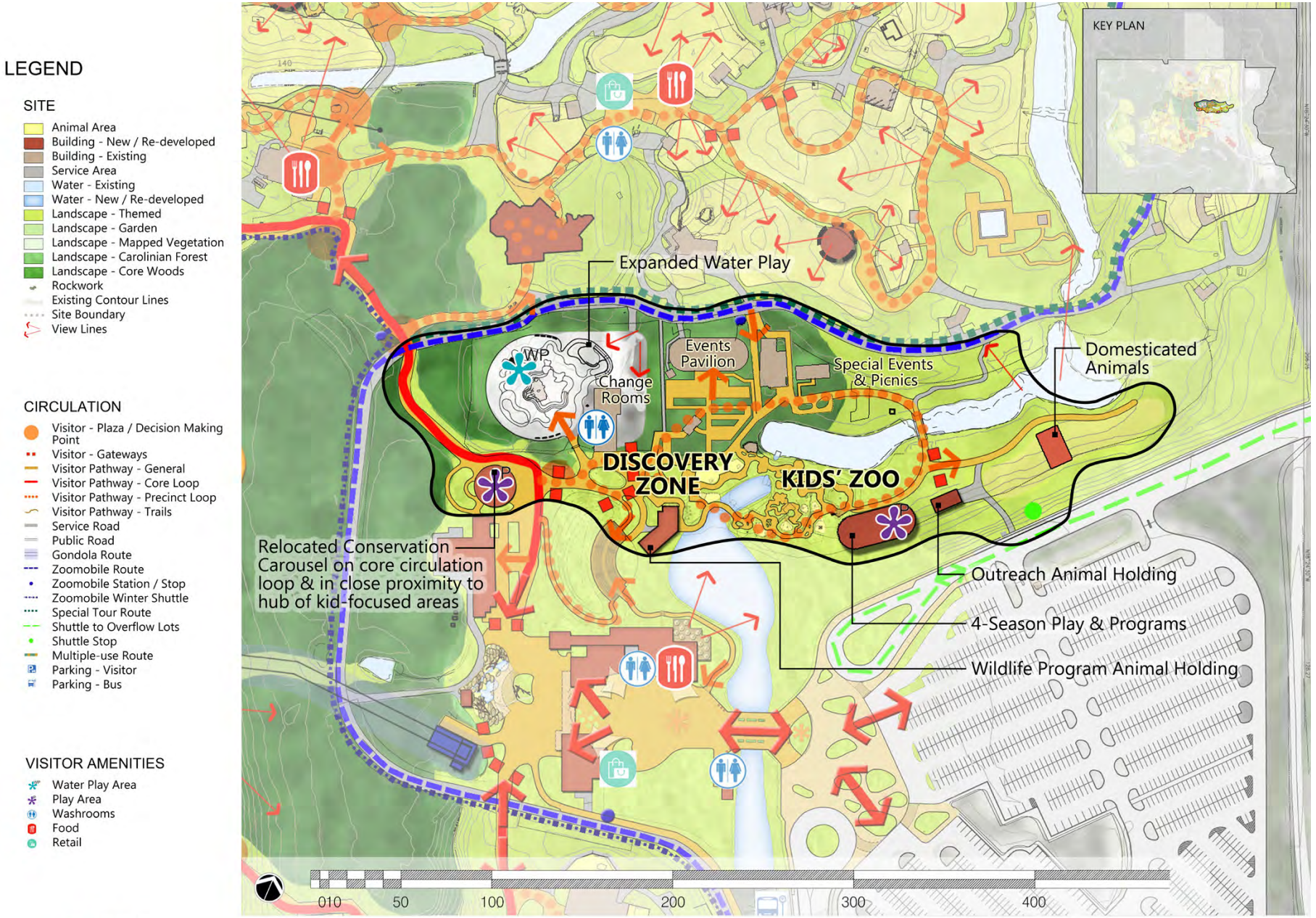
FIGURE 12

DISCOVERY ZONE AND SPECIAL ANIMAL AMBASSADORS

The existing “Discovery Zone” will be expanded to include more year-round, nature-based programs and activities to meet the needs of local parents and caregivers, as well as enhanced facilities for program animals and seasonal domesticated animals. Improvements will include the following:

- A relocated year-round carousel at the entry to the Discovery Zone.
- A 4-season indoor play and program space will provide a destination in all weather for a short visit or to complement a longer journey of discovery through the Zoo.
- Program animal holding and training space adjacent to the Waterside Amphitheatre.
- Outreach animal holding and care area.
- An expanded and updated water play area.
- A special events lawn and picnic area for families and group.

Toronto Zoo Keeper with Red-tailed Boa Constrictor



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Master Plan - "Discovery Zone"

Toronto Zoo Master Plan

November 2016

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FIGURE 13

"Kids Discovery"

Kids Discovery Indoor Play will be a new feature within the children's zone that acts as a play and learning space for young children, and a gathering space for their parents – especially on inclement days when everyone needs to get out of the house.

One option is for the Kids Zoo to be expanded to include Canadian heritage farm animals that are easily approachable by young children in a guided situation so that they have the opportunity to learn about care giving and care taking.

"Bugs!"

Invertebrates and other small creatures will be celebrated in this hugely interactive and engaging discovery and learning space. Much like "Micropia" at the Artis Zoo in Amsterdam, and at London Zoo and Cincinnati Zoo's celebrated insect houses, visitors will be able to experience and go deeper in their appreciation for the diversity of the micro-world around us.

"Program Animals"

Animals used for outreach programs and Zoo presentations are key to delivering to visitors the Zoo's mission and message about care giving. Providing sufficient space for their year-round housing and training will ensure that staff are able to care for them in an exceptional manner.

Hymenopus coronatus - Pure White Orchid Mantis

Dolomedes plantarius - Fen Raft Spider

Zoo Kid with Madagascar Hissing Cockroach

Toronto Zoo

WILDLIFE HEALTH CENTRE DESCRIPTION AND PURPOSE

In 2017, the Toronto Zoo will open its new state-of-the-art Wildlife Health Centre. This significant capital project is an investment in the well-being of the animals in our care as well as an ongoing commitment to scientific research in veterinary medicine, nutrition and reproductive technologies. Creating a facility of this size and scope is at the heart of our expanded vision and will further position the Toronto Zoo as a world leader in wildlife care and conservation.

The construction includes leading-edge sustainable construction techniques, materials and technology, designed to LEED silver standards. When complete, the Wildlife Health Centre will be one of the largest exotic animal medical facilities in Canada at approximately 4550 m^2 (50,000 sq. ft.) of interior space –including the hospital, quarantine and research facilities. The Centre will be easy to maintain in a hygienic state and provide ample room for the treatment of animals, post-operative care and modern diagnostic and research equipment. Veterinary staff will now be able to handle larger species, such as gorillas and polar bears, at the Centre rather than in their habitats on-site.

In addition to the health care services, the Wildlife Health Centre is also home to the Zoo's reproductive physiology lab, numerous conservation breeding programs, turtle head start programs, Amphibian Rescue Centre (ARC), a veterinary residency program, high school co-op programs and many research projects with universities, colleges, government and non-government agencies.

A viewing area for visitors on guided tours will provide a behind-the-scenes look into wildlife health practices and conservation research which will give visitors a more thorough understanding of the significant work being done at the Toronto Zoo to ensure the ongoing survival of so many of the worlds' most vulnerable species, particularly those native to Canada.

Reproductive Physiology

Wildlife Health Centre

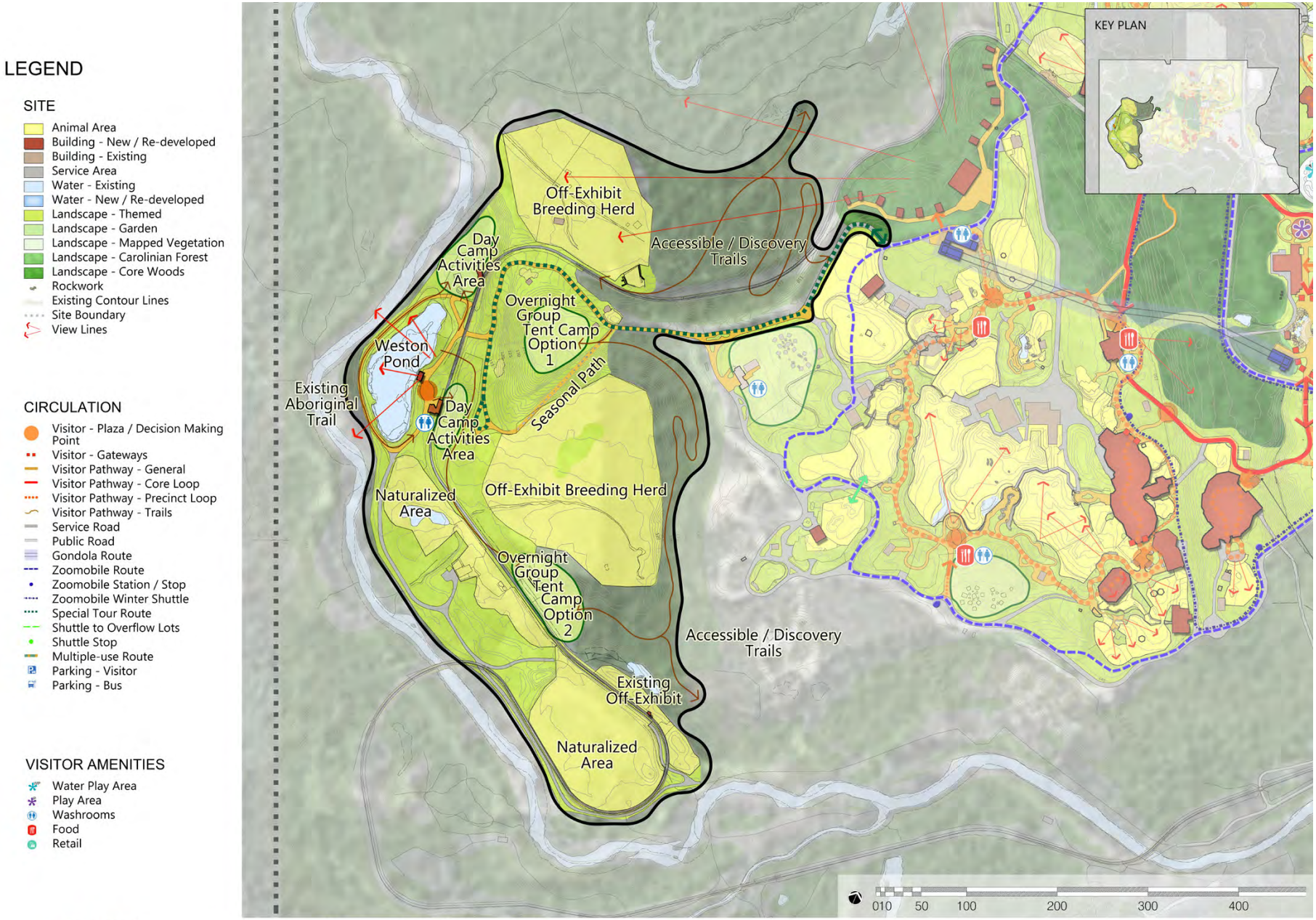
WILD WOODS

As part of condensing the walk between the core offerings of the Zoo without diminishing the overall stay time of effect, the Master Plan envisions the Zoo's valley lands (former "Canadian Domain") being returned to uses that do not rely on day-to-day access by the Zoo's visitors. All Canadian Domain animal habitats would be moved into the new "Wilderness North". However the large meadow enclosures would be maintained to insure the breeding capability and herd health of a number of the Zoo's native herd species.

Thus the original Canadian Domain will transition into a value-added landscape for special group use and conservation education. Holding and shelters for the animals will be improved with an eye to being light on the land, and moving them to higher ground to insure safe retreat from high water in the Rouge River.

Overnight group wilderness camping and day camp areas will be developed in select areas that stay out of prime habitat area and are light on the land. Trails and programs will be developed to insure that all of Toronto's children, and their families, have the opportunity to spend time in the woods and discover the value of the natural framework that surrounds the City.

Weston Pond will continue to be managed as a seasonal breeding area for a variety of wildlife including Trumpeter Swans.



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Master Plan - "Wild Woods"

Toronto Zoo Master Plan

November 2016

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FIGURE 14

EAST CAMPUS

- Festival
- **Browse Demonstration**

FESTIVAL

On the east side of Meadowvale Road, overlooking the Little Rouge Creek valley, stands an iconic structure that symbolizes the recent past of human use of the surrounding landscape: The Red Barn. Currently used for off-exhibit breeding of many of the Zoo's smaller conservation breeding species, it sees no public use, but holds a dominant position on the ridgeline.

The Master Plan envisions the relocation of the conservation breeding functions to the north of Finch Road and the possible future redevelopment of the Red Barn and its immediate area as a native plant horticulture and education centre that can serve as a beautiful locus for learning, functions and events, including seasonal farmers' markets and fairs that spread into the adjacent parking areas, providing yet another reason for the community to visit and become aware of the partnership between the RNUP and the Toronto Zoo.

As a horticultural facility it could celebrate the rich agricultural history of the Rouge Valley, as well as the diverse matrix of native plants and those horticultural varieties that exist in peace with the natives and provide additional color, diversity and food sources for pollinators and other native wildlife.

This area would be connected to the Zoo and the entry to the RNUP by a shuttle that runs among the various main and overflow parking areas, and potentially even an overpass from the main parking area at the entry to the Zoo.

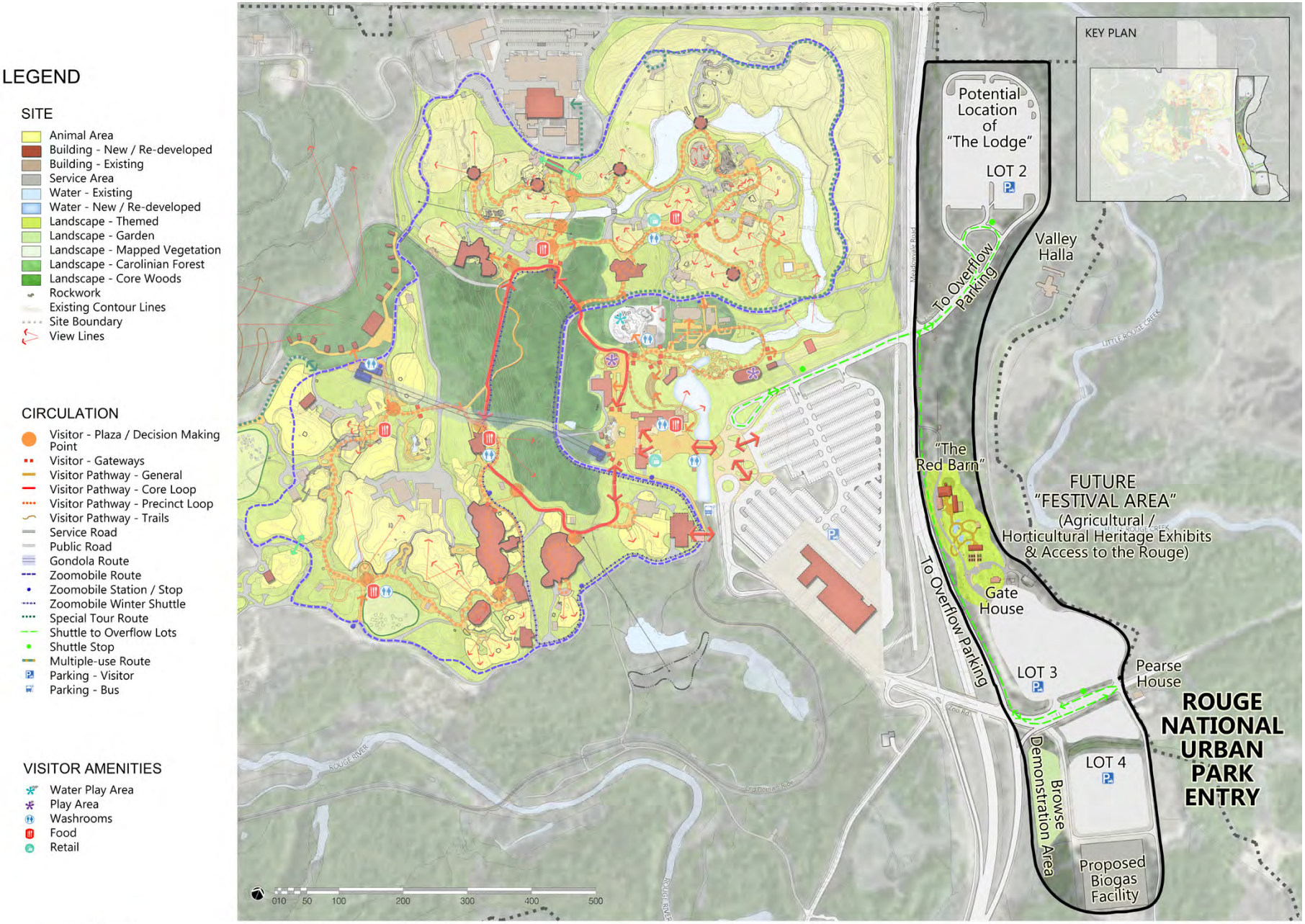
The transformation of this area is not included in the master plan implementation schedule. Details would need to be determined following discussions with RNUP about joint festival area.

BROWSE DEMONSTRATION

At the Toronto Zoo browse is now recognized as an essential dietary and welfare item for many wildlife species. Some browse products are purposely farmed outdoors and some area preserved for winter feeding. Others are collected from lawns and / or forested areas or grown in gardens or greenhouses, pavilions,, or staff office areas and some are purchased. The demand for browse is high and variable, but for some wildlife species, particularly invertebrate and mammalian browsers, more specialized species of browse and areas to grow these area required.

A small browse demonstration area is proposed beside the future Biogas facility in Parking Lot 4. The use of browse offers some important educational opportunities:

- A small browse plantation is animal welfare orientated and could promote visitors understanding through demonstrations, complimented by visitor assisted browse feeding on site.
- An opportunity exists for us to demonstrate how specialized animal food (e.g. medicinal plants, vegetables, etc.) can be propagated in a greenhouse with heat generated as a bi-product from a biogas facility using zoo-poo recycling into biogas digest. This would show how both food and energy can be generated from waste diversion.



Master Plan - "East Campus"

Toronto Zoo Master Plan

November 2016

FIGURE 15

CONSERVATION BREEDING AREA

- Off Exhibit Breeding Area

A portion of the acreage north of Finch Road and opposite the Operations Complex is envisioned as the future home of a world class centre for the Zoo's endangered species ex-situ breeding programs, replacing the existing remote facilities in the Red Barn.

In addition, a protected browse propagation area is proposed in close proximity to the Zoo Operations Complex as part of the Zoo's approach to providing the highest level of care for the animals in its care.

Marmota vancouverensis - Vancouver Island Marmot

LEGEND

SITE

- Animal Area
- Building - New / Re-developed
- Building - Existing
- Service Area
- Water - Existing
- Water - New / Re-developed
- Landscape - Themed
- Landscape - Garden
- Landscape - Mapped Vegetation
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- Rockwork
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- View Lines

CIRCULATION

- Visitor - Plaza / Decision Making Point
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- Special Tour Route
- Shuttle to Overflow Lots
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- Multiple-use Route
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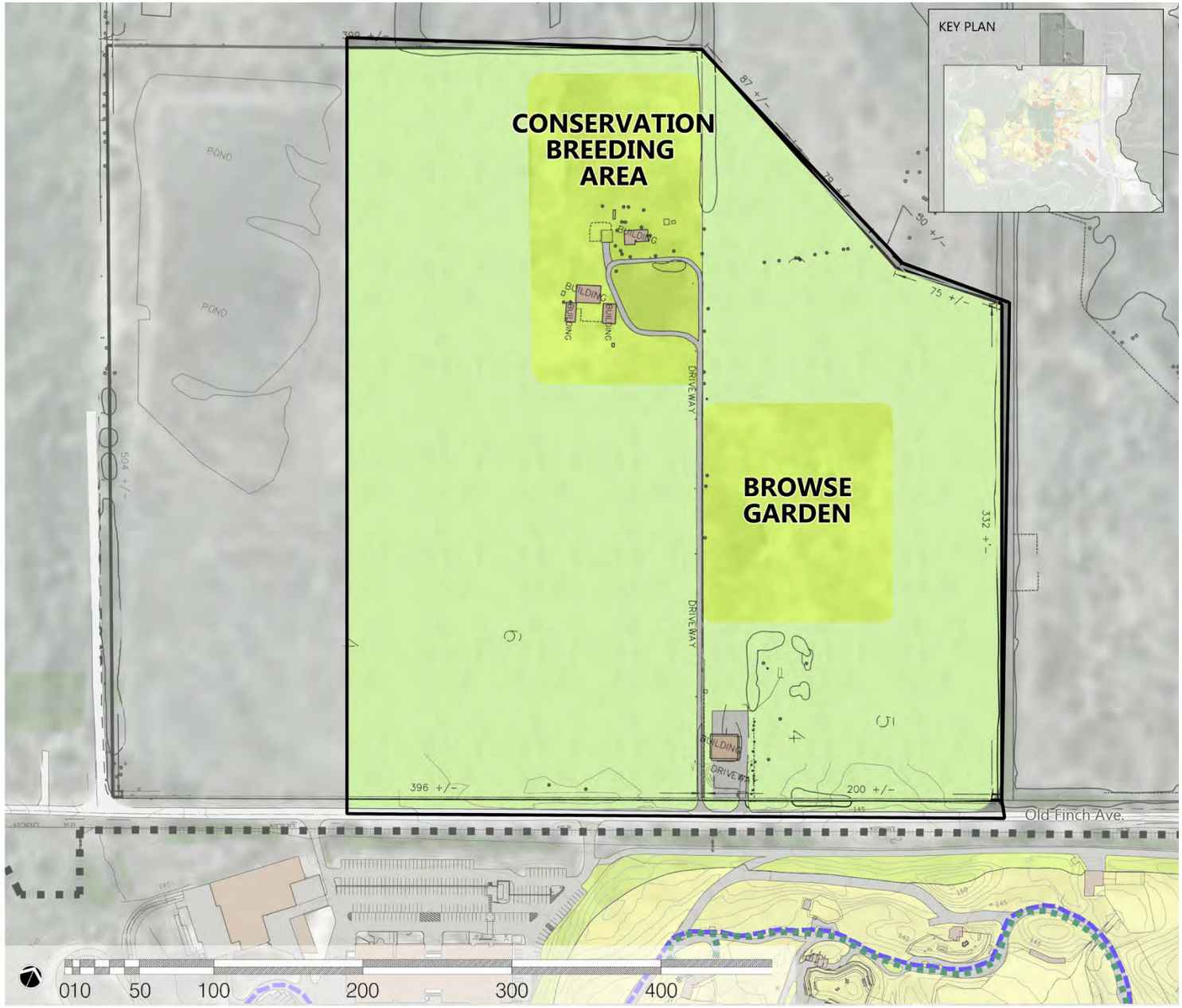
VISITOR AMENITIES

- Water Play Area
- Play Area
- Washrooms
- Food
- Retail



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Master Plan - "Proposed Conservation Breeding Area"

Toronto Zoo Master Plan

November 2016

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FIGURE 16

OPERATIONAL SUPPORT AREA

Back-of-house areas will continue to be investigated for obvious efficiency, circulation and capacity opportunities as the plan unfolds. Key components that have been currently identified include making best use of the new Wildlife Health Centre, the addition of a new food services storage and logistics building, and the renovation of the existing food services area into a shared warehouse for Retail store, and Zoo Supplies.

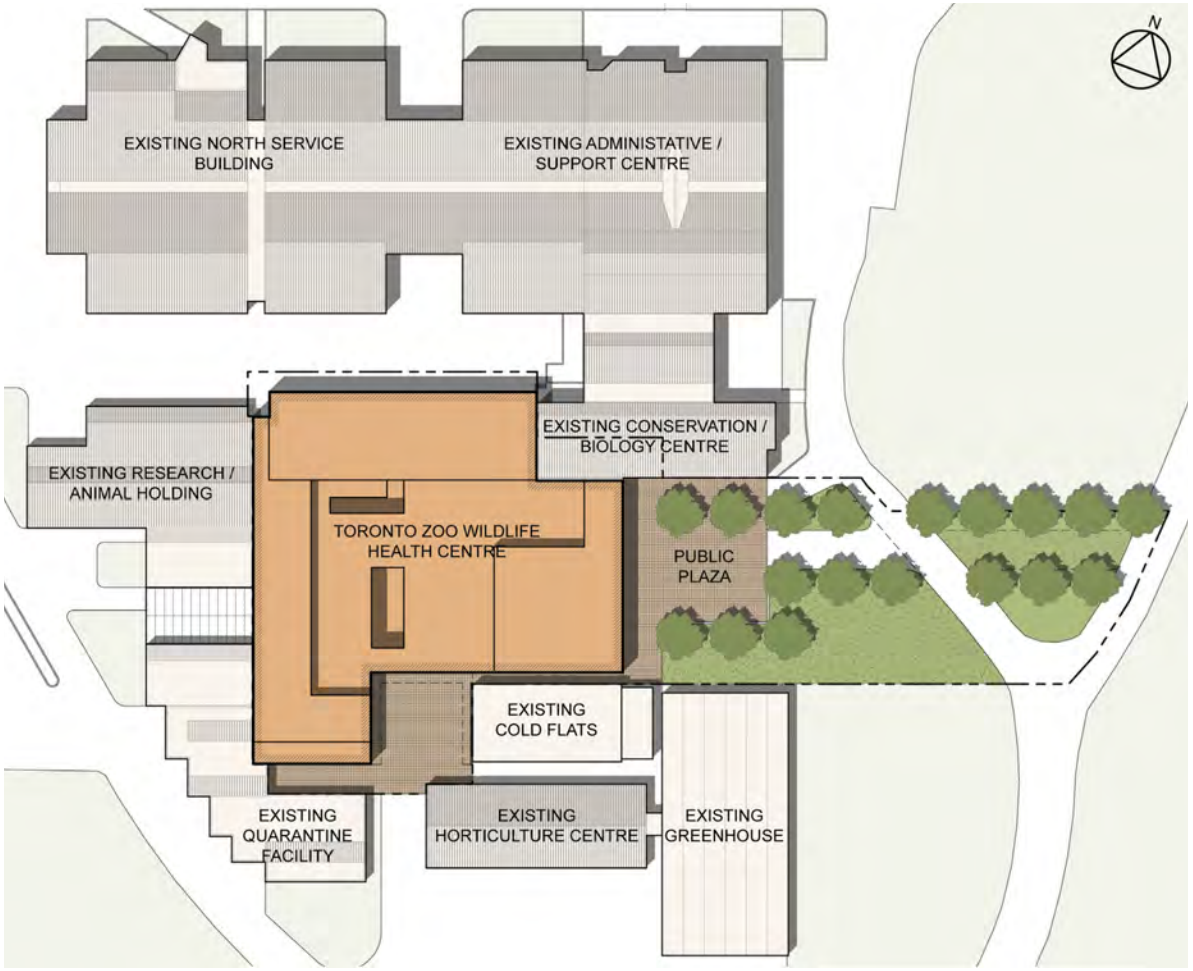

FIGURE 17

LEGEND

SITE

- Animal Area
- Building - New / Re-developed
- Building - Existing
- Service Area
- Water - Existing
- Water - New / Re-developed
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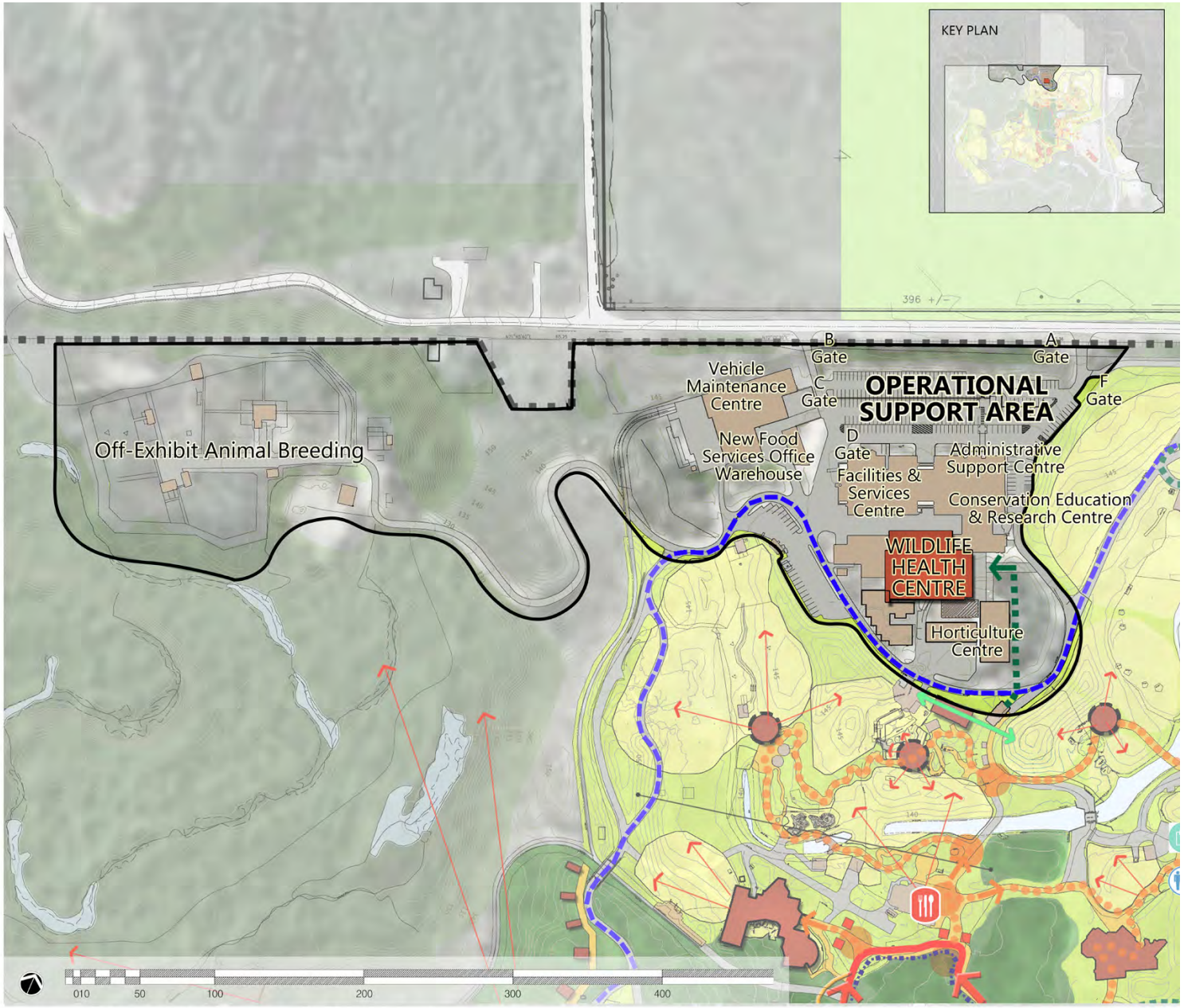

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Master Plan - "Operational Support Area"

Toronto Zoo Master Plan

November 2016

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FIGURE 18

PROGRAM AND USE

VALUE-ADDED EXPERIENCES

The Zoo has the opportunity to develop multiple value-added experiences that will, when appropriately placed, well-planned and well-executed, provide options for further revenue generation.

WETLAND WALK

A guided walk and significant learning experience will be provided to introduce visitors to Canadian species with a focus on some of the wetland habitat and species that currently are or historically were native to the Rouge River and riparian system. Local species will include Canadian Otter (which was extirpated as recently as the 1950's), birds, turtles, amphibians as well as a rich palette of native plant species. The local species and habitat will provide a preferred introduction to the Rouge National Urban Park for many visitors from outside of Canada and opportunities for shared learning and funding with Parks Canada should be explored. Restoration efforts and funding should also be pursued that will support this tour being marketed as an in depth and first class experience to a range of visitors that the Zoo has identified as representing an expanded market.

The walk will be primarily boardwalk with shoreline sections for viewing of diverse plant communities and larger animals such as moose that require a more discrete viewing public. In addition to the native wetland experience, a "constructed wetland" using biotechnologies such as the Living Machine will provide an expanded experience and could be branded as a half day or full day intensive offering. The paid tour and learning experiences also provide a self-funding mechanism for the necessary fundamental work of bringing the waterways and wetlands to functional level that is appropriate to the Zoo's conservation mandate and brand.

Turtle Island

FOOD & REFRESHMENT

A variety of dining options throughout the Zoo provide great food and views. They present food choices and packaging that are consistent with the Zoo's messaging and mission, and highlight Canadian fare and/or feature menus. Dining facilities range in size, style and seasonality, including:

- Fine dining / upscale café / beer and wine garden at the Entry;
- Family dining restaurant (existing Africa Restaurant / future "Gorilla Café") open year-round with the capacity for large groups in thematically appropriate surroundings;
- Area specific, themed cafés with sheltered seating ("Caribou Café", "Grizzly Café");
- Seasonal food trucks that can be moved off-site when not in use (rather than presenting visitors with the look and feel of being closed) ("Lion Overlook", Entry);
- Catered dining and events, made possible with sufficient on-site commissary capacity.

OVERNIGHT STAYS

- Group camping continues to be offered for the Serengeti Bush Camp in a new, more private location with dedicated facilities adjacent to "Pridelands", as well as potentially two new camping areas designated within "Wild Woods". The eventual number of areas and facilities will be determined through a market demand study as the Rouge River National Urban Park comes on-line. Each camp area would be located in a unique setting and have a light footprint on the land that could be easily dismantled for the season or as demand dictates. They would provide unique opportunities for individuals and groups to come together to enjoy the outdoors, learning about wildlife and sharing wild places respectfully and responsibly.
- High-end glamping in "Raven's Roost" provides luxury treetop cabins for rent, featuring stunning views over the valley in a unique, Canadian Carolinian forest canopy experience. A group dining area will provide meals and a place to gather after an evening experience of going behind the scenes to meet the animals. The experience should offer excellent views, great food and be consistent with the mission, messaging and story.
- A potential new lodge and conference center located east of Meadowvale Road within the overflow parking area would have ridge top views of the valley and across to the conservation herds. The lodge actualized through outside investment, but benefits from close proximity and association with the Zoo and a uniquely Canadian experience in the Rouge National Urban Park. Animal exhibits, such as a Great Lakes fish tank, quality theming and unique dining experiences augment the ambience of the facilities.
- The full costing is not used in the programming as the Toronto Zoo would look to partner with an external hotelier to provide the facilities.

Tree House Ravens Roost

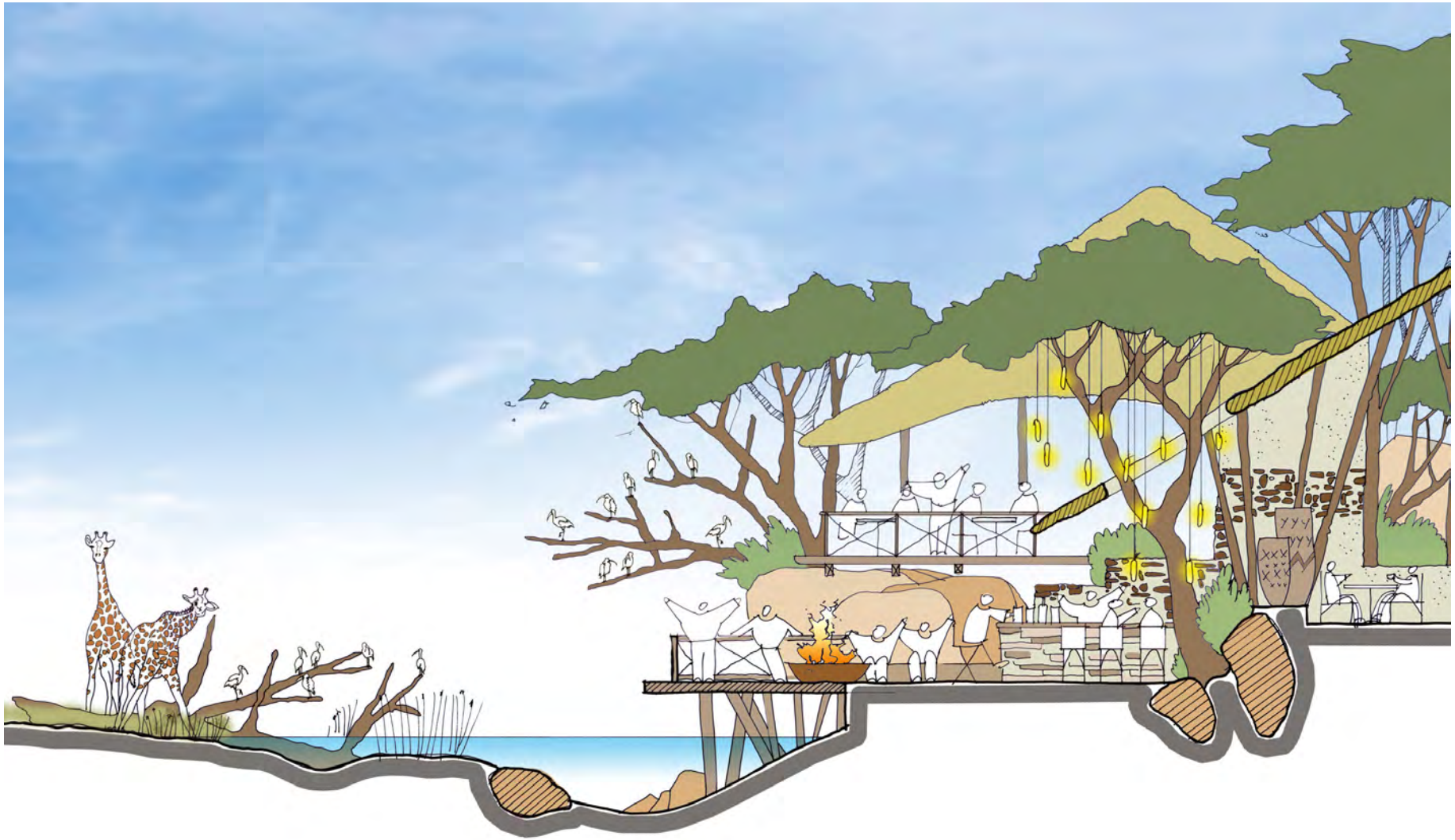


Illustration of High End Glamping

GROUP GATHERING

Several types of rentable group gathering areas have been envisioned by the Master Plan:

- Group Picnic Areas
- Meeting / Function Rooms
- **Birthday Party Rooms**
- Changing Exhibits and Special Events

Each of these areas provides not only a regular revenue stream for the Zoo, but also, by virtue of their siting and association with the Zoo as a leading conservation organization, will attract families and groups who are drawn by the Zoo's mission and motivated by a desire to support it.

Group Picnic Areas:

Pridelands Picnic Area

- Adjacent to the existing Simba Safari Lodge and washrooms, it can host large groups in close proximity to the Savanna animals.

Discovery Picnic Area

- Located within the Children's Zoo, it can host school groups and special events in close proximity to washrooms and shelter.

Meeting / Function Rooms:

Waterside Restaurant – 2nd Floor:

- Located immediately adjacent to the Entry Plaza, the 2nd floor can host meetings of up to 200 people in a divisable space overlooking the Entry Lake. In addition, the downstairs restaurant is easily rentable for evening functions.

The Red Barn:

- On the far side of Meadowvale, the Red Barn can be developed to create several medium-sized rooms with adjacent outdoor spaces to host meetings of up to 50 people and weddings.

Birthday Party Rooms:

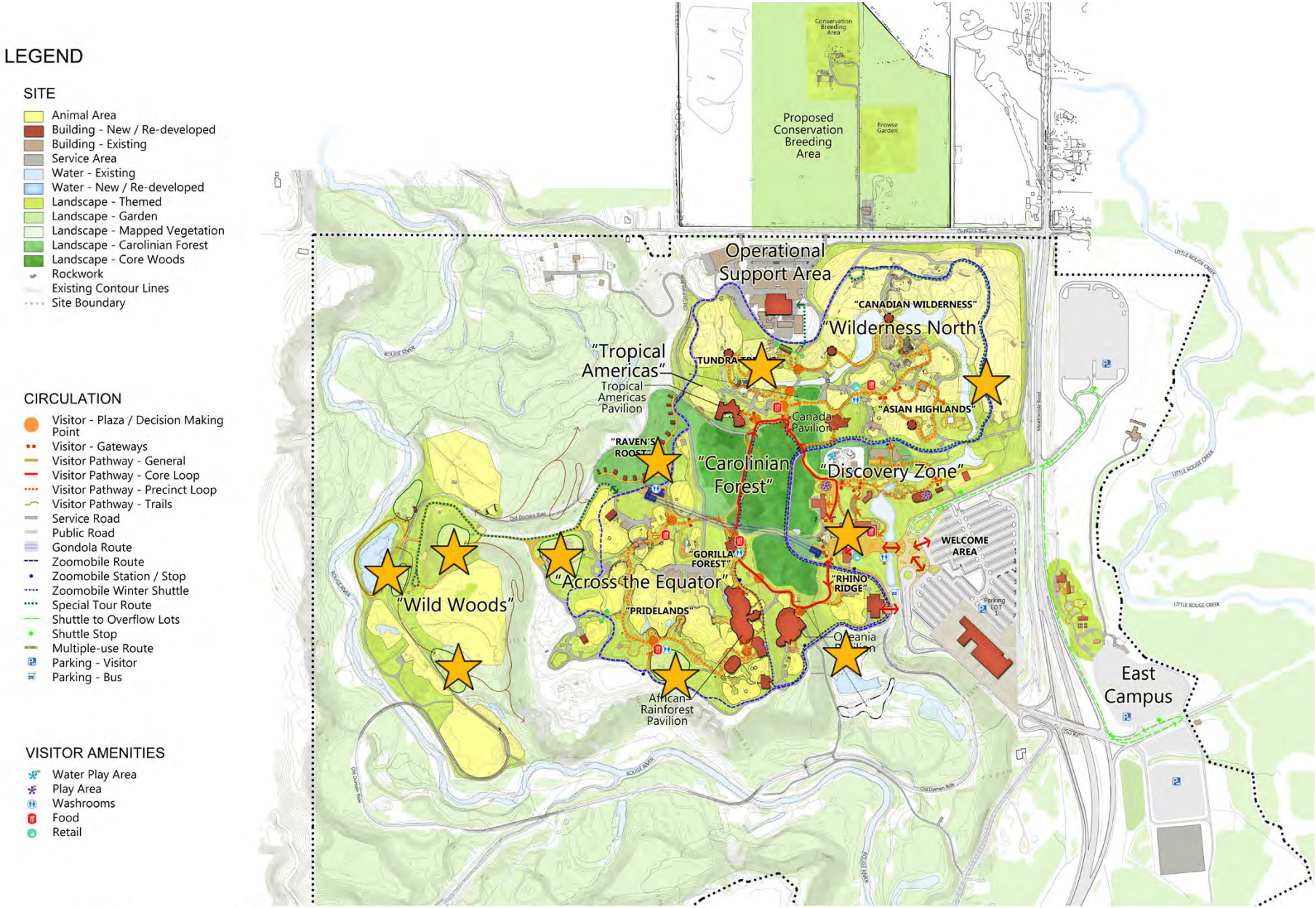
Birthday Party Rooms:

- Two party rooms and associated washrooms will be located in the Discovery Learning Centre. Party rooms provide rental opportunities for birthdays, weddings, and other events. Close proximity between the Carousel, "Bugs!" and "Kids Discovery" Indoor Play space create opportunities for fun-filled events that can be enjoyed year round.

Changing Exhibits and Special Events:

- A new HVAC-equipped "sports tent" enclosure will be erected and will host everything from changing exhibits to Zoo fund-raisers, day camps and special events

Sunset Segway Tours



toronto zoo

Master Plan - Value Added Experiences

Toronto Zoo Master Plan

November 2016

MMM GROUP

FIGURE 19

ADVENTURES

Select activities are enabled through appropriate rides that do not diminish visitor or animal experience of the exhibits, and through adventure play, such as the Eco-adventure tree-top trekking tour and zip line taking Zoo guests deeper into the Rouge Valley. Tree-top experiences area renowned for creating very little footprint in the natural environment, allowing the guests taking the tour to gain a greater appreciation for the environment. The tours have the ability to educate while also being environmentally friendly.

GIFTS

A primary Zoo gift shop located at the Zoo's entry/exit does not require visitors to exit through it, but is so inviting that they cannot help but to stop at the end of their visit to commemorate an excellent day. A garden gift shop and café associated with the Park facilities on the east side of Meadowvale Road appeals to avid or budding gardeners and some of the senior community. It expands the retail product line the Zoo can provide while encouraging sustainable gardening and wildlife-friendly products, such as bat boxes.

PROGRAMS & EVENTS

Paid programs, classes, lectures and events take place throughout the Zoo, supported by new and updated facilities. They are consistent with the Zoo's messaging and mission, and help to support co-aligned Parks programs.

Eco Tour

Toronto Zoo Gift Shop

SITE CIRCULATION

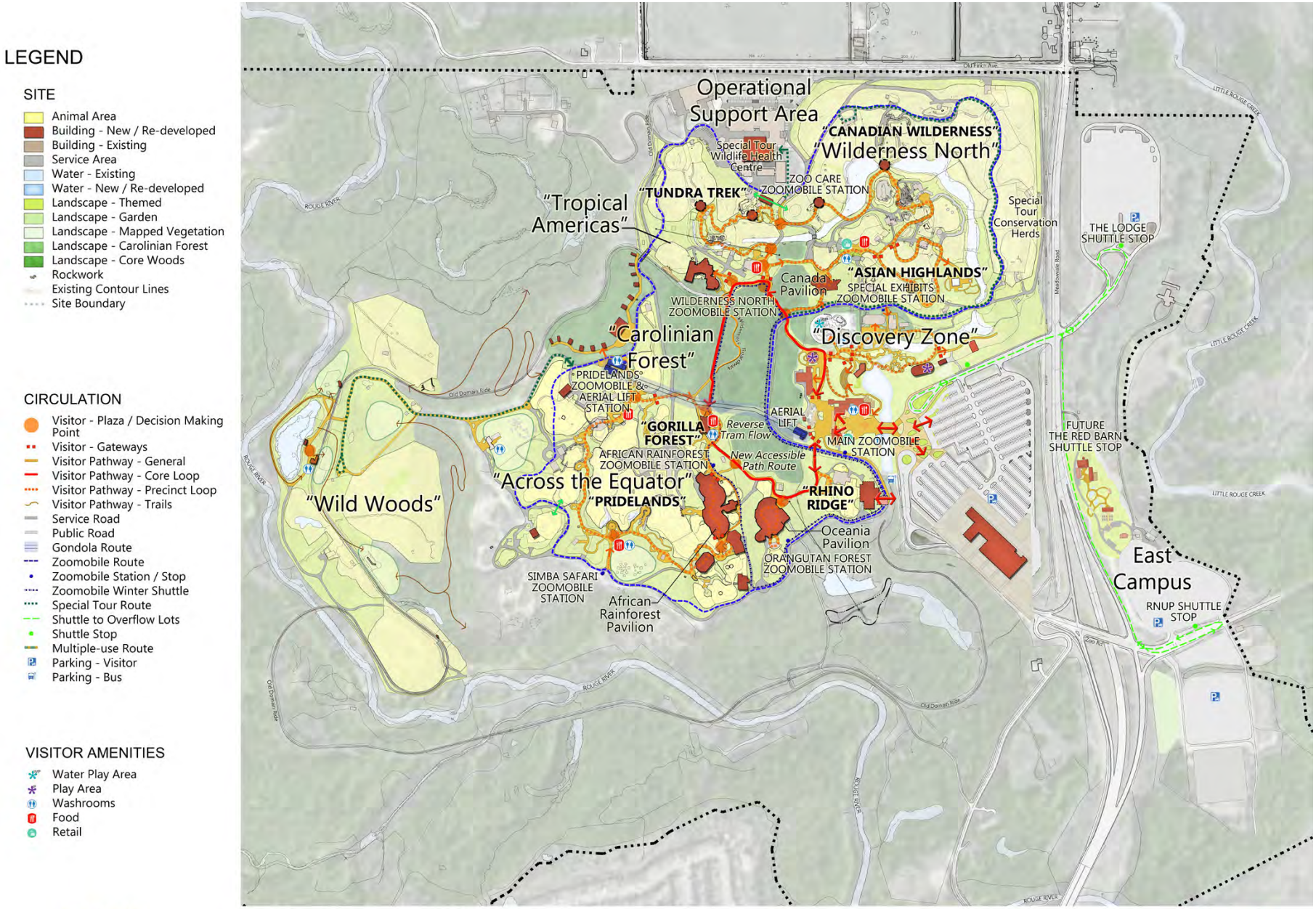
Pedestrian circulation will be redeveloped to create fully accessible routes throughout the Zoo. This has been mandated to occur by 2025, but it is also in the best interest of the Zoo as it considers the needs of not only the disabled community, but also the needs of both young families and senior citizens. The accessible Core Loop will circulate from the Entry to link up the Indo-Malaya Pavilion, the African Rainforest Pavilion, the Gorilla Café, the Carolinian Forest Walk, the Caribou Café, Kids Discovery Zone and back to the Entry. Individual exhibit precinct loops will encompass 20-30 minute walks and include the future "Oceania", "Gorilla Forest", "Pridelands", "Wilderness North", "Kids Discovery" and "Bugs!".

Additionally, accessible trails, as well as challenge trails will be developed through the forested hillslope above the Rouge River, linking the various ponds together for guided hikes and bird watching, as well as access to "Wolf Woods".

Visitor-focused vehicular transportation will be organized to provide the following options:

- Remote Parking and Facilities Transport Route: roofed tram service that operates to link visitors arriving at remote parking spaces with the Entry, as well as visitors who wish to gain easy access to the Red Barn area, the Rouge, or the future Lodge on the east side of Meadowvale Road.
- Carolinian Forest Treetops Transport Route: Should the need be determined, an aerial gondola link between a "transportation hub" adjacent to the Orientation Plaza and the Twiga Retail Store & Snack Bar could be established to provide an easy way to divide up a visit and get back to the Entry. Interpretation in the gondolas could provide information on the nature and care of the central and surrounding Carolinian forest that from the backdrop and framework for the Zoo. This route is potentially capable of being extended across Meadowvale Road to connect with the proposed Festival Area to supplement the Zoo Parking Shuttle loop.
- Summer Zoo Transport Route: combination ride / transportation linkage that provides Zoo-wide back-of-house / alternative views of animals and their habitats, and interpretation about what is going on at the Zoo.
- Winter Zoo Transport Route: a new route that would cover the Core Zoo Area during winter holidays and weekends, and keep visitors from having to walk too far in inclement conditions. It would require a link from the "Gorilla Forest" entry along the east side of the building to connect up with the Giraffe Service Access Road. Additionally, it would require that the Tram Bridge become an all-weather vehicular circulation link.
- Conservation Breeding Herds: Up-Close: Safari-style vehicle for special group excursion for close-ups and feeding of the Zoo's conservation herds.
- "Wolf Woods" Transport Route: Tram route to take special groups and their equipment up and down the slope that leads to "Wolf Woods" from the upper tablelands.

Each of these could be evaluated for whether they are "free" services with the costs included in the price of admission or "value-added" services that can be selected and paid for separately.



toronto ZOO

Master Plan - Circulation Plan

Toronto Zoo Master Plan

010 50 100 200 300 400 500

November 2016

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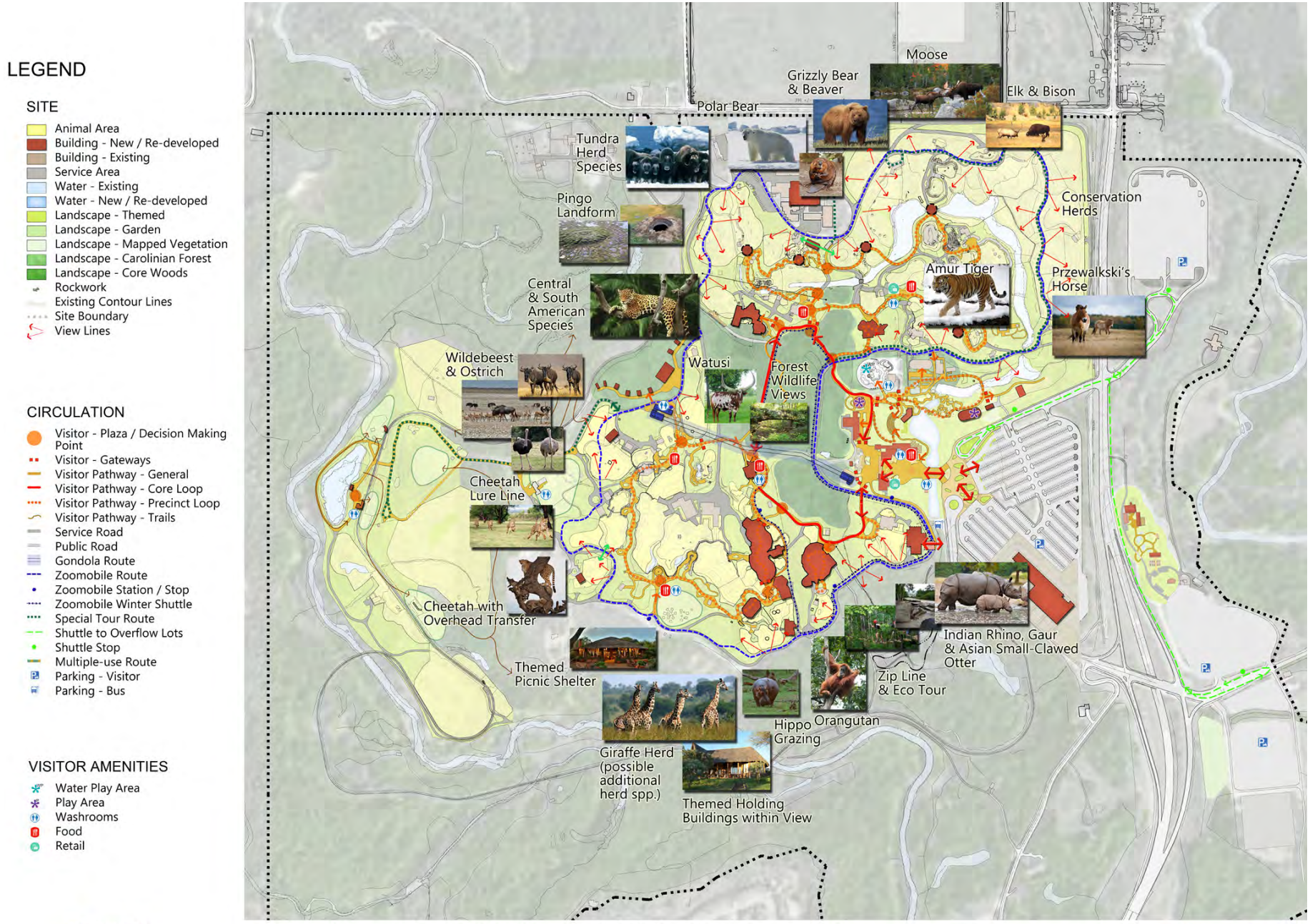
FIGURE 20

TOURS & TRANSPORTATION

- The Zoomobile tour continues to run on a modified route that provides for excellent views and experiences while minimizing overlap with other general circulation routes. A shortened loop can provide key connections without the back-of-house and exhibit tours. during the off-season, allowing for a weather protected visit to the Zoo and a connection to the major pavilions.
- Special tours provide guided access for small groups to experience certain highlighted areas, such as the conservation herds or the Wildlife Health Centre. Staff give behind-the-scenes information and interpretation, and perhaps facilitate interactive animal experiences, such as feeding conservation herd hoofstock.
- An aerial lift from the Zoo entry up the forested slope to the top of the tablelands takes advantage of an existing clear corridor through the trees. It gives visitors an enjoyable ride as they travel easily and directly to the gateway to some of the “must see” animals in the Zoo’s African Rainforest and “Pridelands” as well as an expedited return to the Front Entrance.
- A Zoo Shuttle provides easy loop transportation from remote parking locations, overflow parking, the Festival Area and the future Lodge to the front door of the Zoo. It would run on a regular schedule throughout the peak season

Special Small Group Tours, Northwest Trek, WildlifePark, Eatonville, Washington



toronto zoo

Master Plan - Zoomobile Views Highlight Plan

Toronto Zoo Master Plan

November 2016

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FIGURE 21

PARKING

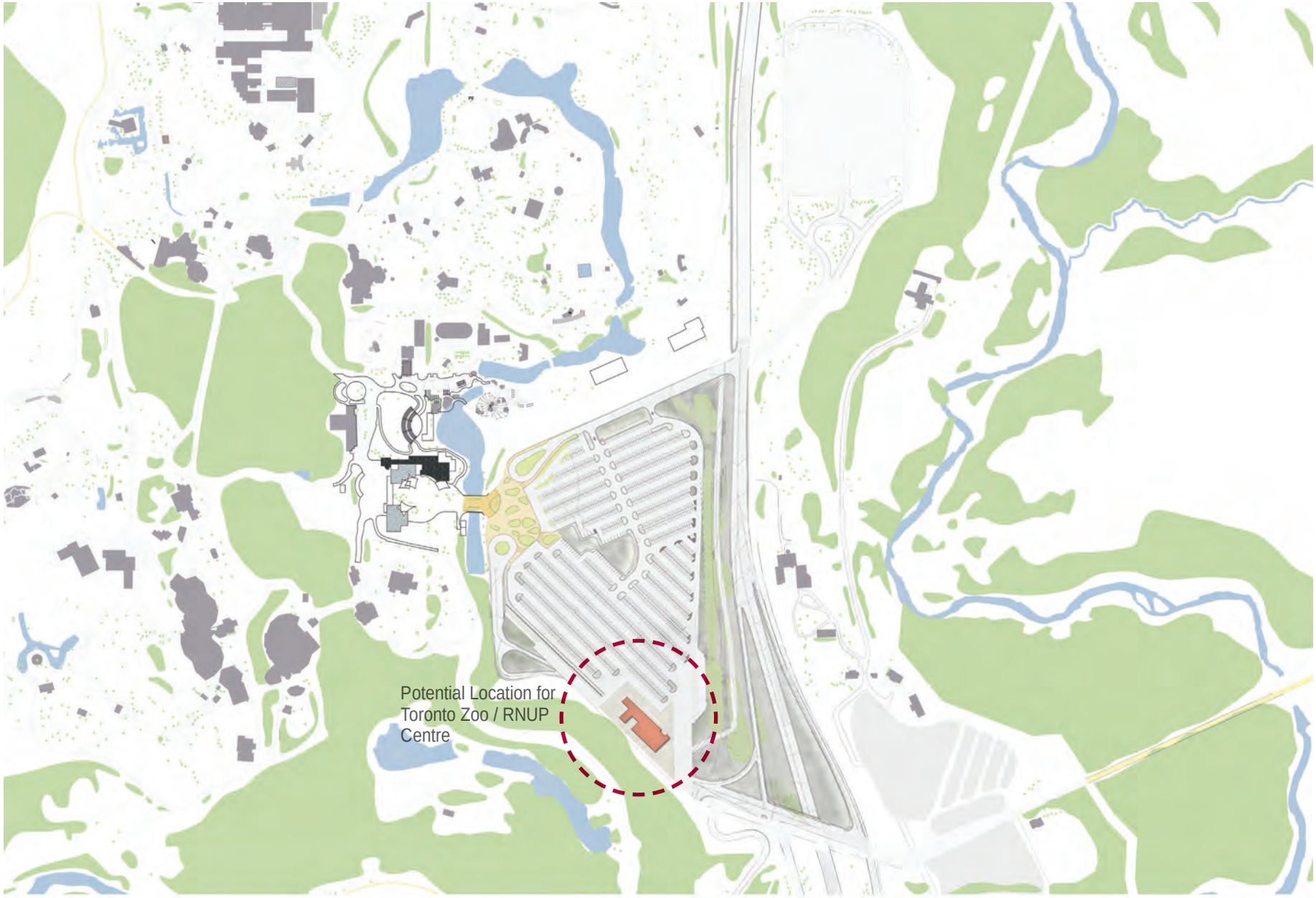
In addition to minimizing the parking footprint the Zoo will green that footprint. All new parking will be designed and constructed to the Toronto Green Standard or a higher Toronto Zoo standard. An objective will be a more natural water and temperature regime which will be achieved by the extensive use of porous pavement and bio-swales.

Parking will be provided for Zoo visitors, with the potential for future Rouge National Urban Park (RNUP) visitors. Current (2016) capacity provides sufficient parking for all but peak days for Zoo visitors. During peak use, the challenge becomes one of traffic, vehicles waiting for passenger pick-up, and expectations management. With the addition of RNUP visitors and/or the removal of any parking spaces for the development of an education centre or lodge, this problem would be exacerbated and could trigger the requirement for a parking structure to minimize the walking distance for Zoo guests.

Primary visitor parking will remain located west of Meadowvale Road, close to the Entrance Plaza, proposed restaurant, Learning Centre and Rouge National Urban Park Shared Use facility.

Parking on the east side of Meadowvale Road is currently configured in two major areas. A large paved lot is located in the north with an entrance drive located directly opposite from the driveway to the Arrival/Departure Plaza. The master plan considers this lot to be a potential redevelopment location for a boutique lodge. Existing parking that would be displaced may be replaced with a parking structure in the main lot. Because the area is already paved, there would be minimal disruption to natural systems. A business feasibility study should be developed that takes into consideration the business model for the lodge as a turn key operation in the context of the business model of the Zoo. Prior to that, a review of regulatory requirements including setback dimension from top of bank, local species inventories, geotechnical and servicing constraints would need to be undertaken.

Two smaller overflow parking areas are located south of the Red Barn and west of Pearse House in the proposed Festival Area. These are currently primarily overflow parking or dedicated to the users of the existing buildings. A series of discrete, appropriately scaled parking areas that are conducive and sympathetic to a pedestrian scaled use should be considered for this area. The parking locations should be developed using permeable surfaces and clearly defined stalls that maximize the efficiency and minimize the per car footprint. Deciduous, native species trees should be planted to shade the vehicles and provide trans evaporative cooling through the leaf canopy. Whenever feasible, the trees should be grown from seed local to the Rouge River riparian zone. The layout of stalls and trees should be designed so that exposure of the vehicles to southern and western sun is minimized.



ENTRANCE PARKING CONCEPT

FIGURE 22

HABITAT PLAN

WETLAND & WATER

The waterways and wetlands of the Zoo offer an extraordinary opportunity to connect past and present the Toronto Zoo and Rouge National Urban Park wildlife and habitat conservation and experience. As recently as the mid 1950's River Otter (Lontra canadensis) was present in the Rouge River. A resilient , playful and intelligent species, otter will make a re-appearance as a signature species in the redesigned Entrance Plaza. They are however, extremely intolerant of pollution, and this provides an excellent learning opportunity to make connections to the history of the Rouge River, the wild species and habitat that traditionally occupied it and the impact of humans on those species and habitat.

Restoration of the Zoo's waterways and wetlands will provide better links between conservation, ecology, visitor experience and water quality. In addition to the Canadian species exhibits such as the Otter exhibit, opportunities will be provided to make connections with the restaurant, a possible wetland walk, bird watching and stormwater re-use technologies such as Living Machines.

STORM WATER

Shallow groundwater around the perimeter of the site flows laterally in a general southerly direction and in response to the contours of the river bank.

Much of the exhibit portion of the site drains to a series of ponds and swales constructed along the perimeter of the site. The parking lot drains to perimeter swales. Based on a visual review of the maps and a physical review of the most readily accessible portions of the site, it appears that the swales discharge to a stormwater management pond located at the south portion of the site west of Meadowvale Road and into storm sewers. We infer that the stormwater pond was originally constructed for erosion and sediment control during the construction of the Zoo when the ground was bare, stripped of vegetation and there was a high risk of sediment wash-off during rainstorms. The majority of the site is now stable with little risk of sediment wash-off during storms, however the animal holding areas and other areas, especially those that are paved, continue to require stormwater management.

Currently there is a stormwater management pond south of the bank on the west side of the main parking lot. We have not evaluated the condition or performance of this pond. It should be monitored for sediment build-up and its current capacity for active storage confirmed. There are a series of smaller ponds and streams on the site that have visible water quality issues Based on discussions with zoo staff, we understand that strategies are under consideration to address these and other storm water quality issues. A Zoo Waterway Quality Study was commissioned in 2004 and the Master Plan will take the recommendations from that study into account.

All storm sewers and the entire Zoo property drains into the Rouge River. The eastern storm facilities outlet into the on-site ponds located within the Zoo properties, which in turn convey flows to the Rouge River. The western portion of the site nearest to the Rouge River discharges directly into the Rouge River or into a small tributary leading to the Rouge River.

Legend

- Water Course / Pond / Wetland
- Forest / Tree / Woodland
- Meadow

HABITAT

FIGURE 23

IMPLEMENTATION

PHASING PLAN AND COST SUMMARY

INTRODUCTION

The following Phasing Diagrams and Cost Summary have envisioned a series of prioritized projects over the next 15 years: between 2017 and 2032. This prioritization has been based upon the Strategic Plan Goals and an evaluation of critical elements that will improve animal welfare, educational opportunities, and visitor circulation and comfort while attempting to establish a reasonable flow of funds to accomplish this important work. The scope of this work includes facility upgrades, habitat renovation and expansion, new facilities to house new programs, and enhancement of revenue generation opportunities that can support both the physical campus of the Zoo as well as its ongoing conservation programs.

Each project references line item cost estimates that are fully documented in the Toronto Zoo Full Costs Spreadsheet that have been provided to the Toronto Zoo staff and summarizes the projected design and construction costs in 2016 dollars. In all cases, these numbers should be considered as target budgets that should be escalated and confirmed through a scoping and preliminary conceptual design process prior to the formalization of a designated construction cost.

The estimated design and construction timelines are necessarily general in nature and reflect common assumptions for completing similar work within similar climatic conditions.

PHASING SEQUENCE

The four major phases are predicated on the following:

- Consolidate the visitor experience to make it easier for guests of all ages to get the most out of a visit to the Zoo without undue fatigue or discomfort.
- Focus the institution's conservation and conservation education on Canadian animals that do well in Toronto's climate and which tie into the messaging of the surrounding Rouge National Urban Park.
- Provide better winter circulation options to assist guests in getting around the Zoo comfortably.

- Provide a more welcoming and better functioning guest arrival and entry experience that reinforces the Toronto Zoo's values.
- Celebrate visitor's transit through the "core woods" to put them in closer touch with the natural habitat that surrounds the Zoo.

- Reinvest in the Zoo's iconic structures and animal habitats to improve welfare and meet the Zoo's accessibility and sustainability goals.
- Create more opportunities for engagement for the families of young children, including those families who live close by and can make use of these opportunities on a regular basis.

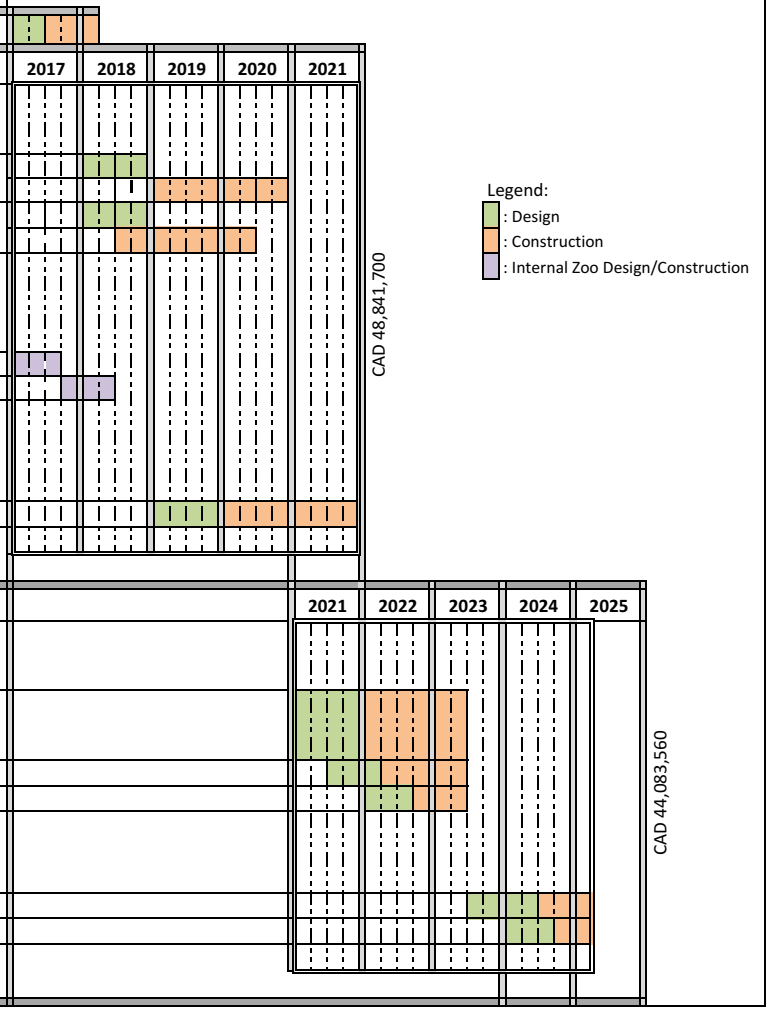
- Complete key animal habitat expansion and renovation, including the Savanna and African Rainforest areas.
- Expand the Zoo's conservation breeding and operations capabilities.

PHASING PLAN

DRAFT Master Plan Phasing Diagram & Distribution of Project Budgets

9-Nov-16

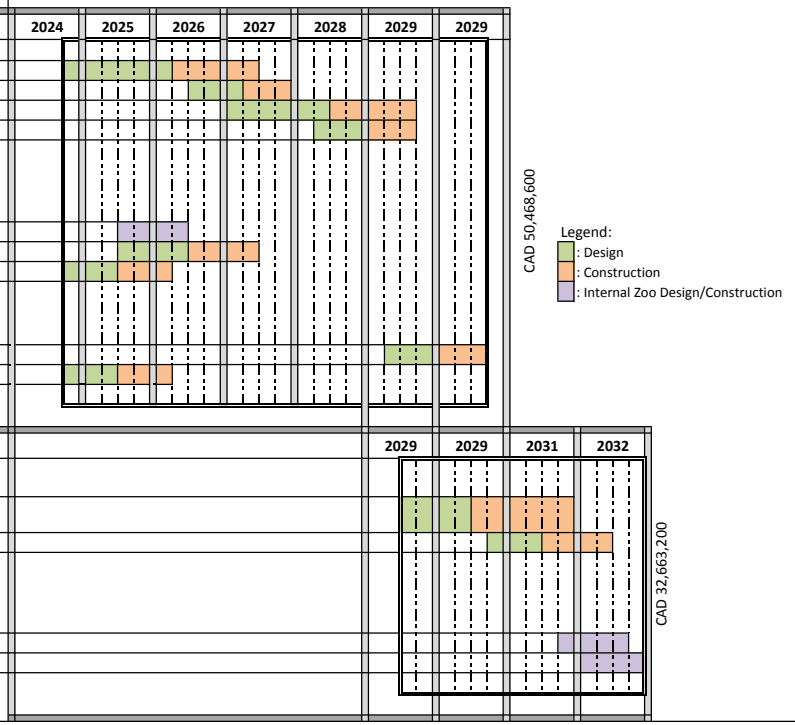
Phase		Description	Strategic Plan Goal	160801 - Full Ref. Cost Sheet Ref. #	Master Plan Capital Improvements Budgets
Prelim.		**DESIGN & CONSTRUCT EXTERIOR ORANGUTAN HABITAT**	1, 2	1, 2	CAD 4,000,000
1	A	**COMPLETE "WILDERNESS NORTH"**	1, 2, 5, 7		
		Complete the conversion of the "Eurasia" exhibit zone to a comprehensive habitat that interprets the diversity of the "Canadian Wilds" experience and contrasts those species to key high altitude / cold-adapted species from Asia.			
		Design of the Canada Pavilion		2.5	CAD 11,473,100
		Construction of the Canada Pavilion			
		Design of "Wilderness North" Elements (incl. River Otter & Carousel relocation)		2.1-2.4, 2.6-2.8	CAD 20,514,100
		Construction of "Wilderness North" Elements			
	B	**IMPROVE WINTER CIRCULATION**	2		
		Complete the construction of a core area ZooMobile route that can be put into service during the Winter to facilitate Guest comfort.			
		Design & Construction of Winter ZooMobile Route		6.4.1	CAD 526,900
		Design & Construction of Accessible Ramp from Indo-Malaya Pavilion		7.3	CAD 1,327,600
	C	**EXPAND DISCOVERY & LEARNING OPPORTUNITIES**	2, 5		
		Construct a new facility that will support formal learning opportunities within the Zoo while also supporting the learning and sharing goals of the surrounding Rouge National Urban			
		Design & Construction of Shared Education / Orientation Centre		3.1	CAD 15,000,000
2	A	**REDEVELOP THE ENTRY & CORE VISITOR EXPERIENCES**	2, 4		
		Re-envision & re-invigorate the Zoo entry experience to facilitate a welcoming experience where ticketing does not interfere with the special Canadian sense of place, where the values of the Zoo are on public display, and where guest services are easily obtainable.			
		Design & Construction of New Entry Elements		1.1 - 1.4, 1.10, 1.12 - 1.13, 4.4.1	CAD 11,840,580
		Design & Construction of New Restaurant/Café at Entry		1.8, 1.9	CAD 8,827,200
		Design & Construction of New Aerial Lift		1.14	CAD 16,190,280
	B	**GET IMMERSED IN THE CAROLINIAN FOREST**	1, 2, 7		
		Enable guests to enjoy the experience of being surrounded by the Carolinian Forest.			
		Design & Construction of "Raven's Roost" Treetop Cabins		8.1, 8.3	CAD 6,501,100
		Design & Construction of "Carolinian Forest Boardwalk"		8.2	CAD 724,400



DRAFT Master Plan Phasing Diagram & Distribution of Project Budgets

9-Nov-16

Phase		Description	Strategic Plan Goal	160801 - Full Ref. Cost Sheet Ref. #	Master Plan Capital Improvements Budgets
3	A	**REINVEST IN SIGNATURE ANIMAL EXPERIENCES**	1, 2		
		Begin the process of renovation and re-investment in the Zoo's iconic structures & animal habitats.			
		Renovation of the "Indo-Malaya Pavilion" to the "Oceania Pavilion"		5.1, 5.4	**CAD 26,946,000**
		Design & Construction of "Rhino Ridge" Improvements		5.2, 5.3	**CAD 2,612,300**
		Renovation of the "Americas Pavilion" to the "Tropical Americas Gallery"		9.1	**CAD 11,768,800**
		Design & Construction of "Insects!" (after new Giftshop is complete)		4.3	**CAD 2,109,800**
	B	**CREATE MORE ENGAGEMENT OPPORTUNITIES FOR THE ZOO'S YOUNGEST GUESTS**	2		
		Expand the opportunities for imaginative play in natural surroundings & holding / training areas for animal ambassador programs.			
		Water Play Expansion		4.6	**CAD 389,900**
		4-Season Play & Program Space		4.7, 3.3	**CAD 2,841,400**
		Wildlife Program Area Improvements		4.5	**CAD 1,523,900**
	C	**CONTINUE CIRCULATION & GUEST SERVICES IMPROVEMENTS**	2		
		Complete improvements to the Entry area.			
		New Gift Shop		1.11	**CAD 1,951,200**
		Renovated ZooMobile Stop at Entry		1.6	**CAD 325,300**
4	A	**COMPLETE KEY ANIMAL HABITAT EXPANSION & RENOVATION**	1, 2, 7		
		Reinvest in expanding & renovating animal habitats & back-of-house care facilities within "Across the Equator" zone.			
		Savanna Improvements		6.1, 6.6, 6.7, 6.9	**CAD 13,094,500**
		African Rainforest Improvements		6.4, 6.2	**CAD 14,219,200**
	B	**EXPAND THE ZOO'S CONSERVATION BREEDING & OPERATIONS CAPABILITIES**	1		
		Use the North Campus to consolidate & expand the Zoo's conservation breeding & browse production capabilities.			
		Conservation Breeding & Browse Production Area Improvements		11.2	**CAD 2,000,000**
		Operations Complex Improvements		12.1 - 12.5	**CAD 3,349,500**



COST SUMMARY

Toronto Zoo

2016 Master Plan Cost Summary

18-Nov-16

Phasing Priority					Budget Sheet Ref. #	Master Plan Capital Improvements Budget	Partnership Opportunity	Notes:
	1.0	**Entry & Circulation Improvements**				**CAD 23,711,880**		
2			1	Parking area improvements	1.1	CAD 4,000,000		
2			2	New Plazas	1.2, 1.3, 1.4	CAD 3,943,100		
3			3	Renovated ZooMobile Stop	1.6	CAD 325,300		Revenue
3			4	New Washrooms	1.7	CAD 767,600		
2			5	New Guest Services, Membership, Offices, Tickets	1.10	CAD 942,600		Revenue
3			6	New Gift Shop	1.11	CAD 1,951,200		Revenue
2			7	New Information & Security	1.12	CAD 316,080		
1			8	New Canadian River Otter	1.13	CAD 2,411,500		
1			9	Carousel Relocation	4.4.1	CAD 227,300		
2			10	New Restaurant / Café / Play Area	1.8, 1.9	CAD 4,000,000	CAD 4,827,200	Revenue
2			11	New Aerial Lift Transportation & Ride	1.14		CAD 16,190,280	(not incl. in Capital Budgets)
	2.0	**Canadian Wilds / "Wilderness North" Improvements**				**CAD 31,987,200**		
1			1	Infrastructure & Circulation Upgrades	2.1	CAD 632,200		
1			2	Expand Tundra Trek	2.2	CAD 3,441,400		
1			3	New Boreal Ridge - Bear Centre of Excellence	2.3	CAD 5,760,600		
1			4	New Beaver	2.4	CAD 1,332,300		
1			5	New Canada Pavilion	2.5	CAD 11,473,100		
1			6	Renovate existing Eurasia exhibits for Asian Highlands (not incl. Amur Tiger)	2.7, 2.8	CAD 5,000,000		
1			7	Renovate Conservation Herds to accommodate photo safaris	2.9	CAD 1,000,000		Revenue
1			8	Renovate existing Eurasia exhibits for Canadian Animals	2.10	CAD 2,975,000		
1			9	Expand tent camping opportunities in the Rouge Valley	7.3	CAD 372,600		Revenue
	3.0	**Discovery & Learning Improvements**				**CAD 15,000,000**		
1			1	Shared Education / Orientation Centre (Zoo portion)		CAD 15,000,000	CAD 15,000,000	Shared
	4.0	**Discovery Zone Improvements**				**CAD 7,615,000**		
3			1	Infrastructure Upgrades	4.1	CAD 223,100		
3			2	"Insects!"		CAD 2,109,800		
3			3	Water Play Expansion	4.6	CAD 389,900		
3			4	4-Season Play & Programs	3.3, 4.7	CAD 2,841,400		Revenue
3			5	Wildlife Program Area Improvements	4.5	CAD 1,523,900		
1			6	Winter ZooMobile Route connections @ African Pavilion	6.4.1.1-3	CAD 526,900		
	5.0	**Carolinian Forest Circulation & Experience Improvements**				**CAD 7,225,500**		
2			1	"Ravens' Roost"	8.1, 8.3	CAD 6,501,100		Revenue
2			2	"Carolinian Forest" Boardwalk	8.2	CAD 724,400		

Toronto Zoo

2016 Master Plan Cost Summary

18-Nov-16

Phasing Priority					Budget Sheet Ref. #	Master Plan Capital Improvements Budget	Partnership Opportunity	Notes:
	6.0	**Savanna Improvement**				**CAD 13,094,500**		
4			1	Infrastructure Upgrades	6.1	CAD 1,368,500		
4			2	Hippo Exhibit & Holding	6.6	CAD 8,000,000		
3			3	Mixed Herds & Holding	6.7	CAD 1,500,000		
4			4	Lion Expansion / Rotational Predators exhibit / Seasonal Café	6.9	CAD 2,226,000		
	7.0	**Indo-Malaya Area Improvements: "Oceania"**				**CAD 34,885,900**		
1			1	Complete exterior orangutan habitat construction		CAD 4,000,000		
3			2	Complete renovation of the building to support a thriving tropical forest for Orangutans, Komodo Dragons and other species, upgrade all roofing and mechanical systems and accommodate accessibility standards.	5.1, 5.4	CAD 26,946,000		
3			3	"Rhino Ridge" Improvements	5.2, 5.3	CAD 2,612,300		
3			4	New Accessible Ramp from Indo-Malayan to upper ridge	5.4.1	CAD 1,327,600		
3	**8.0**	**South America Improvements**			9.1	**CAD 11,768,800**		
	9.0	**Africa Rainforest Improvements**				**CAD 14,219,200**		
4			1	Building upgrades per Indo-Malaya standards + exhibit upgrades.	6.4	CAD 12,000,000		
4			2	Gorilla Outdoor Expansion	6.2	CAD 2,219,200		
	10.0	**Conservation Breeding & Browse Production Improvements**			11.2	**CAD 2,000,000**		
4			1	Small animal breeding facilities				
4			2	Browse plantations				
	11.0	**Operations Support Improvements**				**CAD 3,349,500**		
4			1	Food / Retail Warehouse	12.1, 12.5	CAD 2,000,000		
4			2	Infrastructure Improvements	12.2-4	CAD 1,349,500		
	12.0	**Festival Area Improvements**			10.1 - 10.4		**CAD 12,904,200**	Revenue
				Totals:		**CAD 160,857,480**	**CAD 48,921,680**	

CONCLUSION

It is important to recognize that the Master Plan is a living document. It provides a snapshot in time of the physical and programmatic development that will occur over the next fifteen or twenty years. As the Toronto Zoo changes, the social, political, economic and physical context will change as well. New opportunities will present themselves. The Master Plan will need to be revisited in parallel with the ongoing development of strategies and business models for the Toronto Zoo. The impact and success of each phase of Master Plan implementation should be assessed against the strategic goals of the Toronto Zoo and adjustments to the implementation strategy made to ensure it aligns with broader goals.

The Master Plan provides overall design direction that moving forward will be supported by detailed design development for each project. The project, network and Master Plan scale design strategies should be evaluated individually and collectively at the end of each fiscal year and findings incorporated into upcoming budgets and the business model. The importance of developing the design and budgets in greater detail well in advance of construction drawing and design documentation cannot be understated.

The individual projects described in the Master Plan are connected by a systemic network of mobility and environmental improvements. It is recommended that the system level improvements and strategies be re-evaluated at least every 3-5 years. Implementation of the Master Plan Report recommendations and a close understanding of the design inputs that went into the development will ensure that the detailed design meets the requirements of the various stakeholders and approval agencies, preserves and enhances the ecological integrity of the site, provides for the level of care required by the animals, fulfills the needs and desires of the community, the experiential expectations of visitors and guests and takes advantage of the unique opportunities and potential of the Toronto Zoo.

Lynx canadensis - Canada Lynx

STANDARD OF LIMITATIONS

This report was prepared by MMM Group Limited (MMM) for the Toronto Zoo in accordance with the agreement between MMM and the Toronto Zoo. This report is based on information provided to MMM which has not been independently verified, although visual reviews of the site were undertaken.

The disclosure of any information contained in this report is the sole responsibility of the Toronto Zoo. The material in this report, accompanying spreadsheets and all information relating to this activity reflect MMM's judgment in light of the information available to us at the time of preparation of this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. MMM accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.

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REPORT ON SITE SERVICES STUDY

For

TORONTO ZOO

Prepared for:

Mr. Eric Morris (Manager)
Toronto Zoo
Facilities and Services
361 A Old Finch Avenue
Scarborough, Ontario
M1B 5W6

Prepared by:

PARADIGM ENGINEERING GROUP INC.
Project No: 850

September , 1999

EXECUTIVE SUMMARY

Paradigm Engineering Group Inc. reviewed five systems, which service the site. These are the water, gas, sewer, electrical and communication systems. An overview of each system is found in Section 2 of the Report. This summary is broken down into three components as follows: Terms of Reference, Study Findings and Summary Report.

A. *Terms of Reference*

Subsequent to a proposal dated November 16, 1998, Paradigm Engineering Group Inc. was retained to conduct a Condition Survey of the Toronto Zoo site services located on the Zoo property in Scarborough, Ontario. Authorization to proceed was notified by Mr. Eric Morris, Manager of Facilities and Services on behalf of the Toronto Zoo.

B. *Study Findings*

Water: The physical condition of the water supply and distribution system was found to be generally in good condition. For the most part, the flow rates and water pressures were found to be adequate with the exception of approximately three hydrants where water pressures were found to be low. The findings also revealed that adequate water is available to service the current needs of the Zoo. Any proposed addition or expansion to the Zoo requiring water supply must address the above low-pressure problem.

There are two key areas of concern with the water supply system namely;

1. The entire site is currently supplied from a single line connected to the City. Should a major line break requiring the shut down of the water system occur on a day when the Zoo is very busy with visitors needing access to water, there will be a significant negative consequence, hence we have recommended that consideration be given to the installation of a second linefeed to the Zoo from another City main. For the short term, the sections of water mains that have leaked in the past should be replaced. The cost of this immediate repair is shown in the Appendices.

2. The existing water mains hydrant connections contain some dead ends without a loop. The above feature is not in conformance with the requirements of the City of Scarborough, which required that all lines leading to the fire hydrant be looped.

The long term solution to the first problem is to install a second line fee at an approximate budget cost of $1,000,000. The solution to the second concern is to install loops at all hydrants without loops. Detailed discussion of these concerns and their corrective measures are given in the Appendices.

Gas: The physical condition of the Gas supply and distribution system was found to be generally in good condition. For the most part, the gas flow rates and pressures were found to be adequate. The findings also revealed that adequate gas is available to service the current needs. The adequacy of proposed expansions, including extension of gas facilities to the Eurasia exhibits area will be determined after design loads are known.

Sewers: The audit of the sewer system revealed that the sewer system has adequate capacity to service current needs and proposed expansions, however the entire storm and sanitary sewers contains a significant level of debris. We have recommended a complete flushing of the system to enhance its functional capacity.

Electrical: The audit of the electrical system indicates that there is adequate electrical capacity to service current needs, but any further expansion or addition to electrical energy loads must contemplate and include upgrading the electrical service. The electrical systems and equipment are in fair condition, despite the high incidence of failures. Given the age of the system and the reported frequency of disruption of operation resulting from power failures, we will recommend a phased replacement of all underground cables and submersible transformers.

Communication: The audit of the communication system indicates that there is adequate capacity to service current needs and proposed expansions. The communication equipment and systems are in good condition.

C. *Summary Cost Report*

The attached Portfolio Summary Report details the projected cost requirements for Capital Improvements, Required Repairs and Preventive Maintenance.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Terms of Reference

Subsequent to a proposal dated November 16, 1998, Paradigm Engineering Group Inc. was retained to conduct a Condition Survey of the Toronto Zoo site services located on the Zoo property in Scarborough, Ontario. Authorization to proceed was notified by Mr. Eric Morris, Manager of Facilities and Services on behalf of the Toronto Zoo.

1.2 Scope of Work

In general, the scope of work consists of a Condition Survey of the water, gas, electrical and communication/data services and storm/sanitary sewer systems on the site to determine if any deficiencies exist. The study was broken down into 2 phases:

Phase I	Facility Audit
Phase II	Development of Life Cycle Repair/Replacement and Maintenance Program

Details of the complete scope of work are contained in the Request for Proposal Document and the Proposal.

1.3 Study Goals

The objective of this assignment is to evaluate the existing functional and physical adequacy and capacity of the existing site services at the Toronto Zoo (Zoo) complex and identify retrofit / replacement / repair / maintenance / expansion needs. This survey will address the needs of the Zoo by ensuring that the existing facilities are adequate to meet both the existing demand and reasonably foreseeable future expansion to Zoo facilities.

The Site Services Study is a comprehensive study of the condition of the utility systems and their components. The audit includes a complete inventory of the current use and capacity of the services. A summary of the goals of this project is:

1. Identify and quantify current deficiencies in all components of the services.
2. Develop an understanding of the future needs of the Zoo complex so that the Zoo can predict the funding necessary to maintain the services in an appropriate condition after the reduction or elimination of the current required repairs liability.
3. Provide an inventory of the existing use of the services including renewal cost allocation.
4. Use the study as the basis of a dynamic management tool which will continue to provide an accurate record of the state of the physical plant. The system should be capable of predicting the funding required to maintain desired conditions and will foster the creation of multi-year comprehensive capital implementation plans.

1.4 Study Methodology

Each utility system and site component is inspected and measured. The costs associated with each component are grouped into 3 distinct categories as follows:

Type 1: *Required Repairs Costs*

This category includes costs to rectify actual component deficiencies. All components of the systems, which exhibit or suffer from actual deficiencies at the time of this audit, are referred to as " Required Repairs". These deficiencies will require to be rectified in order to ensure that the components continue to serve their intended functions. All costs associated with required repairs are Required Repairs costs.

Type 2: *Preventive Maintenance Costs*

This category will affect all the components of the systems requiring periodic inspections/servicing and maintenance. For example, a sump pump requiring cleaning every year will be classified under preventive maintenance.

Type 3: *Capital Improvement Costs*

All site servicing systems/components are captured under this category. The repair and replacement of a component is a function of the natural wear/tear and the life expectancy of a component. Over the life of a project, components require periodic renewals in order to maintain the integrity of the facility. All costs associated with capital improvements are called capital improvement costs.

All visible deficiencies for the entire physical plant are identified. Each of the utility and site systems is examined and the remaining useful life of each component is estimated. Finally, the current replacement value of the utility systems and site components is calculated.

The Site Services Study includes deficiencies and anticipated requirements of the utility systems and site components. This comprehensive approach produces a total profile for the entire plant within a conceptual framework consistent with the standard approach for such service systems.

As a physical plant continues to age, additional components wear out. The analysis of life cycle maintenance costs is projected over a long period (25 years for the systems) in order to obtain reasonable average annual projections of the amount of money each component will require to maintain existing conditions.

The information gathered during this audit is analyzed and entered into PEG's Facility Renewal Planning software. The software generates the following three types of reports:

Portfolio Summary Cost Report: This report provides a highly condensed summary of the costs associated with each cost type. The cost columns over the 25-year planning horizon are divided into 10 groups. The costs for the first five years are given on a year by year basis. The costs for the remaining 20 years are put into five (5) year groups. All the future costs are inflated to reflect cost escalation and inflation. The last column gives the subtotal.

Detailed Cost Report: This report provides a condensed summary of the costs associated with each element of repair requirement. The cost columns over the 25-year planning horizon is divided into 10 groups and is similar to the Portfolio Summary Cost described above.

Recommendation Report: This report provides a detailed description of each repair requirements. The report is divided into 7 columns. Column 1 gives an identity number to each repair need. Column 2 describes the location of the repair need. Column 3 gives the priority of the work required relative to other work requirements. A description of the priorities is given below. Column 4 gives the category of the work required. Column 5 gives the description of the deficiency resulting in the need for repairs. Column 6 describes the correction needed to rectify the problem. Alternative solutions are also described. Column 7 gives the budget cost in today's dollar for rectifying the deficiency. The format of the recommendation report for Capital Improvement Costs is slightly different and self-explanatory, consisting of 14 columns.

Priority Ranking Of Recommended Repairs

Each observed required repair is assigned a number that defines the priority of the work relative to others.

Priority No.	Description
1	Repairs of a safety nature where deficiencies have significant probability of harm to people and animals causing death and severe injury.
2	Repairs of a safety nature where deficiencies have significant probability of causing damage to health and minor injuries.
3	Repairs where deficiencies have a risk of consequential damage with high financial cost.
4	Repairs where deficiencies have risk of consequential damage with medium financial cost.
5	Repairs where deficiencies have a risk of consequential damage with low financial cost.
6	Repairs where deficiencies have no risk of consequential damage but are necessitated by the need for upgrades to improve or replace building components.

Categories Definition

All building systems and components repair/retrofit costs are grouped into categories, which define their impact.

Category Name:	Description
Regulatory:	These are costs, which arise as a result of regulatory requirements from all regulatory agencies. For example, costs incurred to upgrade existing access to achieve barrier free access for the handicapped will fall into this category.
Energy:	These are costs associated with energy conservation measures. For example, costs incurred to upgrade lighting fixtures from incandescent to florescent, etc.
Building Integrity:	There are costs, which are related to the overall integrity and soundness of a building, particularly the building envelope and structural systems. For example, rusting and delamination of concrete cladding, cracking of caulking.
Life Safety:	These are costs, which are associated with life and health safety concerns. For example, costs incurred to repair damaged of missing exit signs, dysfunctional heat detectors, etc.
Air Quality:	These are costs associated with health safety, primarily arising from air quality concern. For example, costs incurred to clean the ductwork to improve the quality and flow of air.
Functional:	These are costs, which are associated with upgrading systems to meet their functional requirements. For example, upgrading lighting to higher lux levels, repairing flashing to shed water away from joints, etc.
Appearance	These are cost that is associated mainly with integrity of interior finishes and a esthetic considerations. For example, missing acoustic ceiling tiles, soiled carpet, missing cover plates, etc.
Hazardous Material:	These are costs associated with the removal of hazardous materials.
Environmental:	These are costs associated with environmental concerns such as implementation of the BEPAC program, costs to implement the 3R program, etc.

1.5 Description of the Complex

The Zoo property is a rolling, wooded area approximately 710 acres in extent, with approximately 300 developed acres of discrete, fenced areas for the maintenance and exhibit of wild life from around the world. Individual exhibits are provided with gas, water, electrical and sewage services for the care and comfort of the animals and the patrons, and given the area of the site and its combination of wooded hills and streams, there are several kilometres of underground services to be assessed. All distribution systems are underground. This presents both advantages, such as freedom from damage due to wind, snow, vehicles, animals, etc. and disadvantages such as difficulty of access, flooding, corrosion, etc. Construction of the Zoo complex started approximately 25 years ago and has been on-going since, with further changes and expansions proposed for the near future.

1.6 Acknowledgments and Assembly of the Report

Numerous consultants and specialists have assisted with the investigations and preparation of this document. In some instances, third and fourth opinions have been obtained. Those consulted, including texts, are noted in the appropriate sections.

Under the direction of Paradigm Engineering Group Inc., the following companies comprise the investigation team:

Paradigm Engineering Group Inc.	Prime Consultant Mechanical/Electrical Engineering
A-1 Fire Hydrant Services (Hydrants, Water Valves)	Inspection/Testing Specialists
Trans Video Inspections (Camera Survey)	Inspection/Testing Specialists
Trade Gas Services (Gas Pressure)	Inspection/Testing Specialists
Civil Underground Limited (Soil excavation)	Inspection/Testing Specialists

The assembly of the information required to prepare this comprehensive Site Services Study was coordinated by Mr. Ernest Onyido, P.Eng of Paradigm Engineering Group Inc.

All files, notes, source data, test results and master files are retained in the offices of Paradigm Engineering Group Inc. and remain the property of the Consultant.

All opinions, conclusions and recommendations are those of the Consultant and represent their best judgement under the natural limitations imposed by the scope of work.

1.7 Life Cycle Costing Assumptions

The determination of the life expectancies and replacement costs is somewhat subjective. Every effort has been made to make the numbers as precise as possible, but the actual life of any component may differ substantially from the estimate made. For this reason, we recommend a dynamic approach to the planning and administration of this long term Retrofit/Replacement Program. This report provides a format. It should be reviewed annually as a part of the budget preparation process to reflect actual results and new information available.

The planning horizon for this project is 25 years, however, the projected costs beyond 5 years has limited accuracy and reliability. As a result, we urge that the schedule be revised and issued every five years. The costs for the first five years are given on a yearly basis. The costs for the remaining 20 years are grouped into 5-year increments. Every five years, all work completed should be entered into the system and the next 5 year period will be expanded into yearly costs.

Limitations

This report is limited in scope to only those service system components, which are specifically referenced in the text. Any components not included have not been reviewed.

This report is intended solely for the client named. It should not be distributed further without our knowledge.

All cost estimates are given in current dollars, and are provided for approximate budget purposes only. Accurate figures can only be obtained by preparing detailed specifications, tendering and receiving competitive quotes from suitable contractors. Lifespan projections are estimates only based upon visual evaluation of existing conditions.

As many of the activities covered by the report involve aesthetic qualities, there is an element of judgment in identifying costs and life cycles for certain elements, particularly finishes. While we endeavor to reflect our perception of the existing standards, adjustments to the life cycle cost may be necessary to comply with the expectation of the owners.

2.0 REPORT FINDINGS

2.1 Water System

2.1.1 *General Description of the System*

The above site is supplied with a 14" diameter water main from the City of Scarborough. The water main consists of various pipe sizes and materials. The 14" and 12" mains are of cast iron pipes. The 10" and 8" are of ductile iron and the 4" and 6" mains are made of PVC pipes. There are 29 Fire Hydrants in the existing yards. The incoming pressure is 50 to 55 psi. However, the static pressure drops to about 30 psi in some areas such as the African Savanna exhibit.

The water system comprises of approximately12700 linear meters of piping, 29 fire hydrants, 148 Valves of various types, 1 Pumping Station and 1 Water Main Chamber. Detailed quantity take-off of the major system components of the underground plant are provided in Appendix 14.

2.1.2 *Audit Procedure*

The audit of the water system comprised of a combination of a site walkthrough visual inspection, a review of existing documentation, interviews with maintenance personnel at the Zoo and testing.

a) Site Walkthrough Visual Inspection

The site was visited on several occasions to inspect representative samples of valve chambers, shut off valves, and back-flow-preventers and fire hydrants.

b) Documentation /History Review

We were provided with the site services layout drawings for the water system. In addition, we were provided with a copy of the Energy Report prepared by the City of Toronto Corporate Services, Energy Management Office for 1997.

All the above documentation was thoroughly reviewed prior to our site inspections.

c) Interviews with Zoo and City of Scarborough Personnel

Our inspection team interviewed Mr. Dean Evans and members of his staff during the inspection process to gather information on the types and locations of any known system failures. We also obtained information on the water supply parameters from the City of Scarborough and the Zoo personnel. The audit team also interviewed Mr.Paul Metteta of the City of Scarborough to discuss the requirement of the City of Scarborough for water supply for fire fighting. Mr.Metteta noted that the City of Scarborough requires that the water supply for fire fighting be constructed with a minimum of 8" mains and the mains be constructed in a looped system.

The team also held discussions with various other individuals including Andy Empringham, John Mayock and Steve Doran of the Scarborough Fire Department. The team spoke with Craig Rose of Marshall Macklin and Monagham. Through these discussions, it was revealed that the Scarborough Fire Prevention Department accepted the 1995 modifications to the water main for purposes of fire fighting (see Appendix 17).

A copy of this policy is attached as Appendix 15. The Zoo staff reported that there were two water leaks at the 14" main near the parking lot area. They also stated that the leak was repaired.

d) Testing

Testing was conducted on all fire hydrants to determine flow rates, residual GPM and static pressures. Excavation and examination of the buried water mains for reported leaks were completed in April, 1999.

2.1.3 *Audit Findings*

General Condition of the System

The inspection of a representative sampling of the water supply system and a review of test reports revealed that most of the fire hydrants had adequate water flow rates and pressures. The water flow rate and static/residual pressures were reported to be marginal (30 psi) at two fire hydrant locations, namely; African Pavilion/McDonalds restaurant and the Savana Pavilion/Restaurant. The criteria for minimum pressures needed for fire fighting for a given type of facility is established by the Ontario Building and Fire Codes. The Ontario Fire Marshall's Office has published the "Fire Protection Water Supply" guideline for Part 3 in the Ontario Building Code. See Appendix 18. Table 2 gives the minimum water supply flow rates. Except for the reported water leaks, it is our opinion that the water supply system (buried pipes) is in good condition.

Detailed discussion of our observations is given in Appendixes 1 to 3 under the following cost categories:

i) Required Repairs
ii) Preventive Maintenance
iii) Capital Improvement

2.1.4 *Comment on Existing Usage/Reserve Capacity and Future Requirements*

From our review of the energy report, the water consumption for 1997 was 330,480 cubic meters. In 1995 the consumption was 273,371 cubic meters. There was an increase in water consumption of 20.9% from 1995 to 1997. Our calculations indicate that there is considerable water available to the system, in the order of 5 – 6 times the existing consumption. Water pressure for fire fighting purposes was marginal in some areas. Although water volume is adequate, future expansions or additions to water usage must contemplate upgrading the water system. We have recommended the installation of a second water supply line. This solution will be designed and implemented to address the concern with marginal water pressures. Cost for implementing this system is estimated at approximately $1.0 M

2.2 Gas System

2.2.1 *General Description of the System*

The existing facility at the present time is serviced by a 4" diameter gas main. Distributed throughout the site by a combination of 1", 2", 3" and 4" mains. We understand from the Zoo that the design pressure is 50 psi. However, the actual pressure on-site is about 44 psi. The gas service presently supplies heating equipment such as boilers, make-up air-handling units, furnaces, domestic water heaters and rooftop hot water tanks, pool heaters, McDonald Restaurant kitchen equipment, emergency

generators for various Pavilions, etc. Quantity take-offs of the major system components and the underground plant are provided in Appendix 14.

2.2.2 *Audit Procedure*

The audit of the gas system comprised of a combination of a site walkthrough visual inspection, a review of existing documentation, interviews with Consumers Gas and maintenance personnel at the Zoo and testing.

a) Site Walkthrough Visual Inspection

The site was visited on several occasions to inspect representative samples of the gas regulators, valves, connections and the condition of exposed gas pipes. Selected sites for gas flow tests were chosen to permit inspection and examination of the gas distribution and control system.

b) Documentation /History Review

We were provided with the site services drawings showing the gas mains and branches. In addition, we were provided with a list of all the gas-fired equipment for various areas and pavilions. We were also provided with the following report:

1. Energy Report prepared by the City of Toronto Corporate Services, Energy Management Office for 1997.

All the above documentation was thoroughly reviewed prior to our site inspections.

c) Interviews with Zoo Maintenance Personnel and Consumers Gas

Our inspection team interviewed Mr. Dean Evans, Mr. Gary Bowerman and other members of the Zoo staff during the inspection process to gather information on the types and locations of any known system failures. No system deficiency was reported by Zoo staff, although it was reported by Zoo staff that a gas software survey based on the supply pressure, pipes sizes and lengths, indicated that there is a possible insufficiency in gas supply. The Zoo also reported that the existing Eurasia exhibit presently has no gas supply and heating is currently electric. The Zoo staff stated that it is proposed to supply gas to this area, hence the need to conduct an analysis of the feasibility and cost of this proposal. Mr.Brian Black of Consumers Gas was interviewed and he provided the following information.

a) Ten years ago, there were gas leaks at the Monorail line and the monkey exhibit area. He stated that significant portions of the gas pipes were replaced.
b) The Consumers Gas Company does conduct an annual gas leaks survey at the Zoo covering all underground pipes. He stated that the 1999 survey revealed no leaks.
c) The Consumers Gas Company does not conduct an annual corrosion survey unless leak detection failed.
d) He stated that all the pipes are protected anodes which slows down the corrosion of steel pipes. He recommended that a corrosion survey be completed to assure the integrity of the gas line system.

d) Testing

Gas pressure tests were performed at the main incoming supply and at several other locations including the Indo-Malayan Pavilion and the North Main Service building.

2.2.3 *Audit Findings*

General Condition of the System

An inspection of a representative sampling of gas lines and accessories and a review of the test reports indicated that there is a discrepancy between the design pressure and the actual pressure. The design pressure of 50 psi is higher than the actual test pressure of 44 psi.

Detailed discussion of our observations is given in Appendixes 1 to 3 under the following categories.

i) Required Repairs
ii) Preventive Maintenance
iii) Capital Improvement

2.2.4 *Comment on Existing Usage/Reserve Capacity and Future Requirements*

From our review of the energy report, the gas consumption for 1997 was 2,011,432 cubic meters. In 1995 the consumption was 1,802,733 cubic meters. There was an increase in gas consumption of 11.6% from 1995 to 1997. Discussion with Consumer's Gas indicate that the available capacity of the existing service in the order of 3 times the existing consumption, hence there is adequate capacity for the expansions proposed for the North America area and Eurasia area. Given that the size of the loadings and point of connection on the gas service for the proposed North American area and Eurasia areas are not known, a definite conclusion cannot be made. If the proposed design load is within the existing supply capacity, no upgrade will be required, otherwise the service will have to be upgraded to deliver higher pressure. Consumers Gas has confirmed that the existing supply pressure can be boosted to deliver up to 60 psi to the Zoo system.

2.3 Sewer System

2.3.1 *General Description of the System*

The above site has a 14" Class 2400 A.C. sanitary main which connects to the City main. The 12", 10", 8" and 6" diameter branches serve areas and Pavilions.

The storm main is 42" concrete, class IV, which connects from the site through 27", 24", 18", etc. pipes and storm water is dumped into creeks and the Rouge River. Quantity take-offs of the major system components and the underground plant are provided in Appendix 14.

2.3.2 *Audit Procedure*

The audit of the sewer system comprised of a combination of a site walkthrough visual inspection, a review of existing documentation, interviews with maintenance personnel at the Zoo and testing.

a) Site Walkthrough Visual Inspection

The site was visited on several occasions to inspect representative samples of manholes, catch basins, drains and piping.

b) Documentation /History Review

We were provided with the sanitary and storm sewer site services drawings. All the above drawings thoroughly reviewed prior to our site inspections.

c) Interviews with Zoo Maintenance Personnel

Our inspection team interviewed Mr. Dean Evans and members of his staff during the inspection process to gather information on the types and locations of any known system failures. We were informed of a situation in the African Savannah area where 2 – 8" lines come together into 1 – 12" line. Sewer backup has been experienced in this area.

d) Testing

Based on information from interviews and drawing review, camera surveys of the sewer systems was conducted.

2.3.3 *Audit Findings*

General Condition of the System

A camera survey of a representative sampling of sanitary and storm sewers was done. Deposits of debris and some calcite formation were observed in the sanitary system. Considering then extensive nature of the sanitary system, together with its age and the environmental condition to which it is subject, the system is in overall good condition.

The storm sewer system had considerably heavier debris deposits, to the point where camera access was blocked in numerous runs. The variety and amount of debris is to be expected considering the uncontrolled nature of materials entering the system. Considering the extensive nature of the storm system, together with its age and environmental and loading conditions to which it is subject, the system is considered to be in good condition. The complete flushing of the system is recommended to bring it up to functional adequacy.

Detailed discussion of our observations is given in Appendixes 1 to 3 under the following categories

i) Required Repairs
ii) Preventive Maintenance
iii) Capital Improvement for the sewer system are given in Appendices 1 - 3.

2.3.4 *Comment On Existing Usage/Reserve Capacity and Future Requirements*

Our inspection and review of the videotapes revealed that the existing demand or flow is approximately 20-40% of the available capacity of the sewers. It is our opinion that under the circumstances there is sufficient reserve capacity to accommodate the proposed expansions of Zoo facilities, namely:

- Relocation of the Canadian area to the North American area;

Unlike the electrical and water systems, the actual demand/loading of the storm and sanitary sewer system cannot be precisely quantified. One approach to the determination of existing demand and reserve capacity is to conduct an analysis of storm water run-off and waste water discharge into the system based on the current location of the buildings and facilities and the spatial distribution of the landscaped areas. Results would be compared with information gathered from the original design. The

second approach is to examine and estimate the actual loading in the sewers from a camera survey of selected locations. The latter approach is more realistic and it has been adopted in this study.

2.4 Electrical System

2.4.1 *General Description of the System*

The Zoo property is served by a 3-ph, 27.6kV line fed from a Scarborough Public Utilities Commission pole line on Old Finch Avenue. The service comes in to outdoor 27.6kV, 600A main switchgear on Zoo property and is distributed at 27.6kV through 28kV, single conductor cables running to a number of buried transformer vaults throughout the grounds. Cables are direct buried in sand-filled trenches between transformers, except where the cables pass under roadways where they are installed in concrete duct banks.

Cables are run as often as possible directly between transformers and from transformers to buildings, but there are some instances where splicing for taps has been done directly in the trench. Exterior transformers are submersible type, ranging from 300kVA to 750kVA, 27.6kV input, 208V/120V output to the utilization equipment inside the buildings. There are 49 exterior transformers in 27 underground vaults and approximately 9 miscellaneous outlets throughout the grounds. The parking lots have 33 lighting standards. Quantity take-offs of the major system components and the underground plant are provided in Appendix 14.

2.4.2 *Audit Procedure*

The audit of the electrical system comprised of a combination of a site walkthrough visual inspection, a review of existing test documentation and interviews with maintenance personnel at the Zoo

a) Site Walkthrough Visual Inspection

The site was visited on several occasions to inspect representative samples of manholes, transformer vaults and exterior switchgear. Selected transformer vaults were de-energized to permit inspection of the transformers and the condition of the cabling and vaults. Twenty-five percent of the vaults were inspected.

b) Documentation /History Review

We were provided with the electrical service drawings. In addition, we were provided with two reports on the electrical system, namely:

1. G.T. Wood test report on transformers and switchgear dated December, 1994, reference No. 9951.
2. Black & McDonald -- High Voltage Maintenance Reports dated August 1999, Reference No. 6621
3. Black & McDonald – Submersible Transformer Failure/Replacement Report dated August 1999, Reference No.6638
4. Energy Report prepared by the City of Toronto Corporate Services, Energy Management Office for 1997.

All the above documentation was thoroughly reviewed prior to our site inspections.

c) Interviews with Zoo Maintenance Personnel

Our inspection team interviewed Mr. Dean Evans and members of his staff during the inspection process to gather information on the types and locations of any known system failures. We were informed of approximately 7 cable failures and 2 transformer breakdowns.

d) Testing

Based on information from interviews and document review, testing of the electrical system was not deemed necessary and was not conducted.

2.4.3 *Audit Findings*

General Condition of the System

An inspection of a representative sampling of vaults and cable chambers and a review of repair records was done. Considering the extensive nature of the electrical system, together with its age and the environmental conditions to which it is subject, the overall system is in average condition.

Detailed discussion of our observations is given in Appendixes 1 to 3 under the following categories

i) Deferred Maintenance
ii) Preventive Maintenance
iii) Capital Improvement

2.4.4 *Comment on Existing Usage/Reserve Capacity and Future Requirements*

From our review of the energy report, the electrical energy consumption for 1997 was 10,171,317 kWh. In 1995 the consumption was 10,206,299 kWh. There was a decrease in electrical energy consumption of 0.3% from 1995 to 1997. The Electrical Code requires that the sizing of electrical power services be designed so that the load is no more than 80% of the service capacity. The 1997 demand was reported to be 19031 KW and the available capacity is 22919 KW. This translates to 83% of available capacity. The demand has marginally exceeded the Code prescribed limit. As a result, any further expansion or addition to electrical energy loads must contemplate and include upgrading the electrical service.

Ontario Hydro and the local utilities have been examining their vulnerability to potential Y2K problems and have initiated measures to ensure the continuity of electrical supply.

2.5 Communications/Data

2.5.1 *General Condition of the System*

Bell Telephone service is provided from the pole line along Old Finch Avenue. The service is routed underground to the Administration Building. Bell Telephone Service is located around Pavilions and restaurant areas to supply public telephones but is not extended to the Paddock areas. The system is serviced by a 50-pair underground cable system. The Zoo provides an internal telephone system (PAX), Mitel No. SX-2000SG, fire detection in each building, computer service and security monitoring. We understand that the Zoo purchased (not leased) the Mitel system in 1994 and installed and service it themselves. The Mitel communication system is serviced by 2-200 pair underground cables run to all buildings and areas of the Zoo. Data and power cables may be routed in the same

trench, duly segregated, and use separate cable chambers. Take-offs of the major system components and the underground plant are provided in Appendix 15.

2.5.2 *Audit Procedure*

The audit of the communications/data system comprised of a combination of a site walkthrough visual inspection, a review of existing documentation and interviews with Mitel Corporation and maintenance personnel at the Zoo.

a) Site Walkthrough Visual Inspection

The site was visited on several occasions to inspect representative samples of connections and cables.

b) Documentation /History Review

We were provided with the site services drawings showing the communication line routing.

All the above drawings were thoroughly reviewed prior to our site inspections.

c) Interviews with Zoo Maintenance Personnel

Our inspection team interviewed Mr. Dean Evans and other members of his staff during the inspection process to gather information on the types and locations of any known system failures. It was reported by the Zoo that several pairs in the Bell cable between the old Administration building and the Indo-Malayan Pavilion are inoperative.

2.5.3 *Audit Findings*

General Condition of the System

There have been no reports of dissatisfaction with the Zoo's internal PAX system and all exposed cable and connections which were examined appeared to be in good condition.

2.5.4 *Comment on Existing Usage/Reserve Capacity and Future Requirements*

From our discussions with the supplier, we understand that this system is expandable to provide several thousand lines. We conclude that the existing system is suitable to service any anticipated expansion of the Zoo's facilities with respect to voice communication.

The system is not specifically protected against possible Y2K problems, but if it is being used for communication purposes only, with no business or data transfer applications, date problems will not affect this system and equipment, except as incoming power for the system power supply may be adversely affected.

APPENDIX 1

PORTFOLIO SUMMARY REPORT

Building Name	Replacement	2000	2001	2002	2003	2004	2005- 2009	2010- 2014	2015- 2019	2020- 2024	SubTotal
Capital Improvement											
Toronto Zoo	$1,150,000.00	$85,000	$118,450	$108,212	$79,223	$187,960	$266,009	$571,292	$406,648	$392,535	$2,215,329
Capital Improvement	**$1,150,000**	**$85,000**	**$118,450**	**$108,212**	**$79,223**	**$187,960**	**$266,009**	**$571,292**	**$406,648**	**$392,535**	**$2,215,329**
Preventive Maintenance											
Toronto Zoo	$1,150,000.00	$55,600	$57,268	$58,986	$60,756	$62,578	$342,204	$396,708	$459,893	$533,142	$2,027,135
Preventive Maintenance	**$1,150,000**	**$55,600**	**$57,268**	**$58,986**	**$60,756**	**$62,578**	**$342,204**	**$396,708**	**$459,893**	**$533,142**	**$2,027,135**
Required Repairs											
Toronto Zoo	$1,150,000.00	$338,150									$338,150
Required Repairs	**$1,150,000**	**$338,150**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$338,150**
Total		**$478,750**	**$175,718**	**$167,198**	**$139,978**	**$250,538**	**$608,212**	**$968,000**	**$866,541**	**$925,678**	**$4,580,614**

APPENDIX 2

DETAILED COST REPORT

REQUIRED REPAIRS

CAPITAL IMPROVEMENT

PREVENTIVE MAINTENANCE

Detailed Cost Report

Toronto Zoo

Required Repairs

ID	Recommendation	2000	2001	2002	2003	2004	2005- 2009	2010- 2014	2015- 2019	2020- 2024	SubTotal
ELECTRICAL											
ELRR-001	Primary and Secondary Cables	$20,000									$20,000
ELRR-002	Flooding of Cables										$0
ELRR-003	Main Outdoor Switchgear	$10,000									$10,000
ELRR-004	Outdoor Switchgear										$0
ELRR-005	Vaults	$3,000									$3,000
ELRR-006	Power Cables										$0
ELRR-007	Transformers										$0
ELRR-008	Black & McDonald Report	$45,000									$45,000
ELECTRICAL	**Sub Total**	**$78,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$78,000**
WATER SYSTEM											
WSRR-001	Main	$100,000									$100,000
WSRR-002	Hydrant	$500									$500
WSRR-003	Hydrant	$500									$500
WSRR-004	Hydrant	$2,000									$2,000
WSRR-005	Hydrant	$600									$600
WSRR-006	Hydrant	$400									$400
WSRR-007	Hydrant	$150									$150
WSRR-008	Hydrant	$600									$600
WSRR-009	Hydrant	$500									$500
WSRR-010	Hydrant	$2,000									$2,000
WSRR-011	General	$40,000									$40,000
WATER SYSTEM	**Sub Total**	**$147,250**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$147,250**
STORM/SANITARY SEWER											
SSRR-001		$30,000									$30,000
SSRR-002		$300									$300
SSRR-003											$0
SSRR-004											$0
SSRR-005											$0
SSRR-006		$10,000									$10,000
SSRR-007		$2,000									$2,000
SSRR-008	None	$65,000									$65,000
SSRR-009	General	$600									$600
STORM/SANITARY SEWER	**Sub Total**	**$107,900**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$107,900**

ID	Recommendation		2000	2001	2002	2003	2004	2005- 2009	2010- 2014	2015- 2019	2020- 2024	SubTotal
GAS SYSTEM												
GSRR-003	General		$5,000									$5,000
GAS SYSTEM		Sub Total	$5,000	$0	$0	$0	$0	$0	$0	$0	$0	$5,000
Required Repairs		Sub Total	$338,150	$0	$0	$0	$0	$0	$0	$0	$0	$338,150
Toronto Zoo		Sub Total	$338,150	$0	$0	$0	$0	$0	$0	$0	$0	$338,150
		Total	$338,150	$0	$0	$0	$0	$0	$0	$0	$0	$338,150

SITE SERVICES ASSESSMENT FOR LONG TERM FACILITY RENEWAL PLANNING,
TORONTO ZOO 361A Old Finch Road,
Scarborough

Detailed Cost Report

Toronto Zoo

Capital Improvement

Project Number 98820
26-Oct-99

METROPOLITAN TORONTO ZOO

ID	Recommendation	2000	2001	2002	2003	2004	2005- 2009	2010- 2014	2015- 2019	2020- 2024	SubTotal
ELECTRICAL											
ELCA-004	Replace underground cable between North	$50,000									$50,000
ELCA-005	Replace Light Standards - 6% every 5 years.			$6,365			$7,829		$9,628	$11,842	$35,664
ELCA-006	Repair Transformer Vault -20% every 10 yea							$20,159			$20,159
ELCA-007	Replace 30% of elec. Panels every 5 years.			$5,305			$6,524		$8,024	$9,868	$29,720
ELCA-008	Replace transf. 4 every 2 years	$25,000		$26,523		$28,138	$61,521	$107,057	$82,678	$143,875	$474,791
ELCA-009	Replace underground power cables between		$103,000								$103,000
ELCA-010	Replace underground power cable between			$39,784							$39,784
ELCA-011	Replace underground power cables between				$68,295						$68,295
ELCA-012	Replace underground power cables between					$56,275					$56,275
ELCA-013	Replace underground power cables between						$86,946				$86,946
ELECTRICAL	**Sub Total**	**$75,000**	**$103,000**	**$77,976**	**$68,295**	**$84,413**	**$162,819**	**$127,215**	**$100,330**	**$165,585**	**$964,634**
WATER SYSTEM											
WSCA-002	Replace 20% of water valves every 4 years.					$90,041		$114,061		$144,489	$348,590
WSCA-003	Replace 20%. Of druinking fountains every 5						$1,391		$1,870		$3,261
WSCA-004	Replace 30%. Of manholes in 15 years								$37,391		$37,391
WSCA-005	Replace pumping station in 5 years						$34,778				$34,778
WSCA-006	Repairs to 20% water main chamber in 15 yr								$15,580		$15,580
WSCA-007	Replace 100 feet of water mains every 2 yrs.			$21,218			$23,881	$57,130	$34,049	$38,322	$174,600
WATER SYSTEM	**Sub Total**	**$0**	**$0**	**$21,218**	**$0**	**$90,041**	**$60,050**	**$171,191**	**$88,889**	**$182,811**	**$614,200**
STORM/SANITARY SEWER											
SSCA-001	Replace pipes - 6 m every 5 yrs.						$11,593		$15,580		$27,172
SSCA-002	Replace pumping station in 10 yrs.							$107,513			$107,513
SSCA-003	Repair 50% of manholes in 15 yrs.								$77,898		$77,898
SSCA-005	Replace 100% of area drains in 13 yrs							$10,280			$10,280
SSCA-007	Replace in 10 years.							$107,513			$107,513
SSCA-008	Replace 50%. Of manholes in 15 yrs								$46,739		$46,739
SSCA-010	Replace 50%. Of Catch Basins in 15 yrs								$46,739		$46,739
STORM/SANITARY SEWER	**Sub Total**	**$0**	**$0**	**$0**	**$0**	**$0**	**$11,593**	**$225,306**	**$186,956**	**$0**	**$423,855**
COMMUNICATION SYSTEM											
CSCA-002	Allowance for equip. technology unpgrade							$20,159			$20,159
CSCA-004	Underground communication cables betwee	$10,000									$10,000
CSCA-005	Underground communication cables betwee		$12,360								$12,360
CSCA-006	Underground communication cables betwee			$7,957							$7,957

ID	Recommendation		2000	2001	2002	2003	2004	2005- 2009	2010- 2014	2015- 2019	2020- 2024	SubTotal
CSCA-007	Underground communication cables betwee					$10,927						$10,927
CSCA-008	Underground communication cables betwee						$10,130					$10,130
CSCA-009	Underground communication cables betwee							$12,752				$12,752
COMMUNICATION SYSTEM		**Sub Total**	**$10,000**	**$12,360**	**$7,957**	**$10,927**	**$10,130**	**$12,752**	**$20,159**	**$0**	**$0**	**$84,284**
GAS SYSTEM												
GSCA-001	Repair Gas system valves - 20% every 2 ye				$1,061			$1,194	$2,857	$1,702	$1,916	$8,730
GSCA-002	Repair gas/fittings - 6 m every two year			$3,090			$3,377	$3,690	$8,437	$10,075	$5,748	$34,416
GSCA-003	Repair regulators/memters - 20% every 5 ye							$13,911	$16,127	$18,696	$21,673	$70,407
GAS SYSTEM		**Sub Total**	**$0**	**$3,090**	**$1,061**	**$0**	**$3,377**	**$18,795**	**$27,421**	**$30,473**	**$29,338**	**$113,554**
Capital Improvement		**Sub Total**	**$85,000**	**$118,450**	**$108,212**	**$79,223**	**$187,960**	**$266,009**	**$571,292**	**$406,648**	**$377,733**	**$2,200,527**
Toronto Zoo		**Sub Total**	**$85,000**	**$118,450**	**$108,212**	**$79,223**	**$187,960**	**$266,009**	**$571,292**	**$406,648**	**$377,733**	**$2,200,527**
		Total	**$85,000**	**$118,450**	**$108,212**	**$79,223**	**$187,960**	**$266,009**	**$571,292**	**$406,648**	**$377,733**	**$2,200,527**

SITE SERVICES ASSESSMENT FOR LONG TERM FACILITY RENEWAL PLANNING,
TORONTO ZOO 361A Old Finch Road,
Scarborough

Detailed Cost Report

Toronto Zoo

Preventive Maintenance

Project Number 98820

26-Oct-99

METROPOLITAN TORONTO ZOO

ID	Recommendation		2000	2001	2002	2003	2004	2005- 2009	2010- 2014	2015- 2019	2020- 2024	SubTotal
WATER SYSTEM												
WSPM-001	Fire Hydrants -Water System		$5,500	$5,665	$5,835	$6,010	$6,190	$33,851	$39,243	$45,493	$52,739	$200,526
WSPM-002	Fire Hydrants		$5,800	$5,974	$6,153	$6,338	$6,528	$35,698	$41,383	$47,974	$55,616	$211,464
WSPM-003	Fire Hydrants		$5,800	$5,974	$6,153	$6,338	$6,528	$35,698	$41,383	$47,974	$55,616	$211,464
WSPM-004	General		$4,000	$4,120	$4,244	$4,371	$4,502	$24,619	$28,540	$33,086	$38,356	$145,837
WATER SYSTEM		**Sub Total**	**$21,100**	**$21,733**	**$22,385**	**$23,057**	**$23,748**	**$129,865**	**$150,549**	**$174,528**	**$202,326**	**$769,290**
STORM/SANITARY SEWER												
SSPM-001	Catch Basins, Manholes and Drains		$12,000	$12,360	$12,731	$13,113	$13,506	$73,857	$85,620	$99,258	$115,067	$437,511
SSPM-002	Storm/Sanitary sewers		$10,000	$10,300	$10,609	$10,927	$11,255	$61,547	$71,350	$82,715	$95,889	$364,593
SSPM-003	Buried Pipes		$1,000	$1,030	$1,061	$1,093	$1,126	$6,155	$7,135	$8,271	$9,589	$36,459
SSPM-004	Buried Pipes		$1,500	$1,545	$1,591	$1,639	$1,688	$9,232	$10,703	$12,407	$14,383	$54,689
STORM/SANITARY SEWER		**Sub Total**	**$24,500**	**$25,235**	**$25,992**	**$26,772**	**$27,575**	**$150,791**	**$174,808**	**$202,651**	**$234,928**	**$893,252**
GAS SYSTEM												
GSPM-001	Gas Lines and Valves		$10,000	$10,300	$10,609	$10,927	$11,255	$61,547	$71,350	$82,715	$95,889	$364,593
GAS SYSTEM		**Sub Total**	**$10,000**	**$10,300**	**$10,609**	**$10,927**	**$11,255**	**$61,547**	**$71,350**	**$82,715**	**$95,889**	**$364,593**
Preventive Maintenance		**Sub Total**	**$55,600**	**$57,268**	**$58,986**	**$60,756**	**$62,578**	**$342,204**	**$396,708**	**$459,893**	**$533,142**	**$2,027,135**
Toronto Zoo		**Sub Total**	**$55,600**	**$57,268**	**$58,986**	**$60,756**	**$62,578**	**$342,204**	**$396,708**	**$459,893**	**$533,142**	**$2,027,135**
		Total	**$55,600**	**$57,268**	**$58,986**	**$60,756**	**$62,578**	**$342,204**	**$396,708**	**$459,893**	**$533,142**	**$2,027,135**

APPENDIX 3

RECOMMMENDATION REPORT

REQUIRED REPAIRS

CAPITAL IMPROVEMENT

PREVENTIVE MAINTENANCE

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
ELRR-001	General General	6	Functional	Primary and secondary cables are haphazardly arranged in the vaults, often buried in the mud on the vault floor.	*To avoid damage from the gravel and from workers stepping on the cables, and to lessen tripping hazards in the confined space, it is recommended that cable racks be installed and used in the transformer vaults.*	$20,000.00
ELRR-002	General General	4	Functional	On occasion, vaults and cable chambers are flooded by runoff or temporarily rising water tables. We understand that the drains or weeping tiles have been installed at locations where this is a continuing problem.	*We recommend that these vaults be monitored frequently during the spring and after heavy rain. We understand that many cables are up to 25 years old. Althought this age is much lower than the expected life of the cables, it would be prudent to expose them to as little abuse as possible and the use of cable racks is recommended for this purpose. The cost of this item is included in item ELRR-001 above.*	$0.00
ELRR-003	General General	3	Functional	The main outdoor switchgear was observed to suffer from rust and metal damage.	*It is recommended that the entire assembly be examined, repainted and recaulked.*	$10,000.00
ELRR-004	General General	3	Functional	It was noted that ice formed inside all windows on the main outdoor switchgear. This indicates the presence of high humidity and condensation which can lead to insulation failure and reduction of electrical spacings.	*It is recommended that condensation prevention measures be undertaken such as the installation of heaters or forced ventilation. The cost of this is included in item ELRR-003 above.*	$0.00
ELRR-005	General General	6	Functional	Some vaults were not numbered in the field. Vaults were not always numbered on the drawings.	*It is recommended that all vaults be consicuously numbered in the field to match the numbering system on the drawings. Un-numbered vaults on the drawings should be assigned numbers.*	$3,000.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
ELRR-006	General General	6	Functional	Over the last 5 years, Toronto Zoo reported approximately seven breakdowns related to the 27.6 KV cable. For the most part, the breakdowns were rectified by simply removing and replacing the defective sections of the cable. From our review of the history of these problems and their correction, augmented with our site inspection, the most plausible cause of the cable failures appears to be manufacturing defects.	*This problem could be caused by a combination of several factors such as age, environmental condition, loading and manufacturing defects. We did not find any evidence pointing to either environmental conditions or loading as causes of the reported cable failures. Cables are suitable for direct burial and there was no evidence of excessive heat or humidity or corrosive soil conditions. The most plausible cause of this problem is age and manufacturing defects. Given the length of the run of the service cables it is not unexpected to experience some cable failures. From theoretical considerations, it can be expected that up to 10 feet per 1000 feet of cable will fail and be replaced every 12 years. Based on this, there are two remedial options available. The first one is to replace the entire buried cable system with new cable. This option is not feasible because of cost considerations. The second option is to set aside an annual budget to repair and replace sections of the cable. This option appears to be the most viable under the circumstances and this has been recommended. The cost of this option is given in the section on Capital Improvement. It is further recommened that all occurences of cable failure be properly documented, describing the cost of repair, nature and location of the problem and the type of repair conducted.*	$0.00
ELRR-007	General General	6	Functional	One transformer blow out was reported at the Lion House in 1996. One transformer blow out was reported at the African pad in 1996. Both occurences were repaired. It was reported that repair workmen determined that these failures were the result of faulty installation by the contractor who installed the units.	*This rate of failure can be anticipated. The theoretical life of a transformer is 30 years, however, repair of up to 10% is anticipated to a transformer every 10 years. Given the above facts, and the history of the transformers, it can be resonably concluded that the transformers have performed within expectation. There is no required repair. Allowance for periodic replacements has been made in the section on Capital improvement. We have allowed for replacing 4 transformers every two tears. In addition, we recommend that all accurences of transformer failures be documented, including repair cost and the nature and location of repair.*	$0.00
ELRR-008	General General	2	Functional	The High Voltage Maintenance Report completed by Black & McDonald dated August 1999, Reference Number 6621 contained 23 deficiencies. These deficiencies should be rectified.	*It is recommeded that all the deficiencies listed in the Black & McDonald Report be rectified. The cost indicated here does not include the cost of replacing the transformers which have been included in the Capital Improvement Schedule.*	$45,000.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
WSRR-001	General General	6	Functional	It was reported that on the 14" diameter main there were two leaks which were repaired to remedy the problem temporarily. Three sections of pipe were excavated and exposed for inspection. Approximately 7 feet of the pipes were exposed and at two locations the joints were also exposed. Our inspection of the exposed water mains revealed that the mains were made of ductile iron and that the original protective coatings are still on the pipes. The incidences reported appear to be isolated. There was no evidence of pipe deterioration.	*There are two possible solutions to this immediate problem (1) Replace approximately 200 LM of the 14" Main at the vicinity of the leaks. This can be perform at a cost of approximately $ 40,000.00 (2) Design and install an alternative incoming main adjacent to the existing main of approximately 8 inches PVC to be brought from the city main and tied to the 14" main upstream. The new adjacent line should be designed to have a valve at the point where it joins the existing main. We estimate that this line will be approximately 600 LM long and tied at a point sufficiently far away from the sections currently exhibiting leakage problems. In the event of a leak at the section of main between the city main and the point of intersection of the 8 inch line, the 14 inch main can be shut off and repaired while the 8 inch main continue to supply the Zoo's minimum water flow requirements. This is an outline specification which must be properly designed by a registered engineer. The budget for this work is (600 x $175/lm) $100,000. We recommend the second option because replacing any of the section of the 14" does not guarantee that there will not be any further leakage.*	$100,000.00
WSRR-002	General General	4	Life Safety	Hydrant: The Hydrant near the South end of the Indo-Malayan Pavilion has a minor leak at the ground flange.	*Service and repair the hydrant to stop the leak.*	$500.00
WSRR-003	General General	4	Life Safety	Hydrant: The Hydrant outside the Gorilla exhibit doors, at the inside/outside holding area leaked when fully charged.	*Service and repair the hydrant to stop the leak.*	$500.00
WSRR-004	General General	4	Life Safety	Hydrant: The Hydrant near the inside/outside holding reported marginal test pressure.	*Retain a serviceman to service this hydrant.*	$2,000.00
WSRR-005	General General	4	Life Safety	Hydrant: The secondary valve of the Hydrant North of the North American Pavilion (Century make), seized when in the open position.	*Service and repair valve on hydrant.*	$600.00
WSRR-006	General General	3	Functional	Hydrant: Leaks were noted at the operating nut packing on the Hydrant North of the Australasia McDonald's restaurant.	*Service and repair. Replace packing.*	$400.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
WSRR-007	General General	5	Life Safety	Hydrant: The left 2-1/2" port cap is missing on the Hydrant South of the Greenhouse.	*Replace missing 2-1/2" port cap.*	$150.00
WSRR-008	General General	5	Life Safety	Hydrant: The secondary valve box is broken and the lid is missing from the Hydrant at the East side of the garage. Although still operble, the box has mud in it and needs repair/replacement.	*Replace the broken secondary valve box and the lid.*	$600.00
WSRR-009	General General	4	Life Safety	Hydrant: The Hydrant East of Society was flushed, but a flow test could not be done because of the existing site condition (walk ways) and the secondary valve was inoperable since the valve box was full of dirt.	*Service and repair valve box.*	$500.00
WSRR-010	General General	6	Life Safety	Hydrant: Most of the Hydrants are not identifiable by number or area in the field. It is recommended that the Hydrants be conspicuously numbered in the field to match the numbering system on the drawings.	*Provide and install identifying number tags to match the numbering system on the drawings. Complete the numbering system on the drawings.*	$2,000.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
WSRR-011	General General	4	Life Safety	The flow and pressure tests on the hydrants revealed that the static and residual pressures ranged from 35 psi upto 65 psi. All fire hydrants tested in excess of 600 gpm at 20 psi. the Ontario Fire Marshal's office design guideline for water supply specifies the minimum water supply flow rate to be 1800L/min for buildings that one storey in building height and does not exceed 600 cubic meter in building area. This recorded flow rates and pressures exceed this minimum requirepment. The Ontario Building Code and Ontario Fire Code require that all existing and new fire protection systems meet the approval of local Fire chief i.e., the requirements of the Scarborough Fire Department. The City of Scarborough Fire Department require that fire hydrants be connected to the water main through a looped system. In addition, they require that the water main be 8" but that smaller sizes may be used if hydraulic calculations supporting required water supply were conducted. From our review of the drawings, there are two dead ends in the water system, mainly at the recently developed African Savannah complex. Based on the above observations, the existing water system is not in conformance with the City of Scarborough Fire Department requirement with respect to the lack of a complete looped system. As a result, the requirements of the City of Scarborough Fire Department, must be addressed.	*Preliminary consultation with city official reveal that they require as a solution to this problem, that all dead ends be removed from the system and a loop be installed at all fire hydrants. The installation of the loop at each hydrant increases the reliability of water supply. The cost of design and construction of a loop at each hydrant increases the reliability of water supply. The cost of design and construction of a loop to each of the two hydrants will be approximately $20000 per hydrant at a total cost of $40,000. This cost is very high and the effectiveness is limited. Hence, we recommend that the Toronto Zoo meet with and negotiate appropriate variance from the city because of the cost prohibitive nature of the remedy. Consideration should be given to the cost of the remedy, the effectiveness of the remedies and the overall impact of the system.*	$40,000.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
SSRR-001	General General	4	Functional	Storm Sewer: A camera inspection of the storm sewers was conducted at a representative sample of the storm sewer system. The camera inspection revealed various deficiencies in the sewer as listed below. Piping North of Indo pavilion has light debris 7m away from manhole 2.	*conduct a complete flushing of the entire storm system piping, clean all manhole in the entire complex.*	$30,000.00
SSRR-002	General General	5	Functional	One extra manhole is not shown on the drawing.	*Update the existing drawing to show one extra existing manhole.*	$300.00
SSRR-003	General General	4	Functional	Piping East of old elephant house had calcite at service connection. Calcite was also noted at othe rlocations. Given that only 5% of the entire storm sewer system was inspected with the camera, it is suspected that these deficiencies do occur at other locations.	*Conduct scrubbing an reaming of the sewer system at locations were calcite is identified. In order to determine the locations where calcite formation has occurred, a complete camera inspection of the entire storm sewer should be conducted. Scrubbing, reaming and possibly grouting techniques should be employed to rectify the calcite problem. This budget include the price of completing a 100% camera survey of the storm sewer and conducting necessary remedies as described above. The budget for this deficiency is included in the cost of item SSRR-008 shown below.*	$0.00
SSRR-004	General General	4	Functional	Storm Sewer: Piping east of Rouge River has light debris under the flow.	*Conduct flushing of the system piping. The cost of this is included in item SSRR-001.*	$0.00
SSRR-005	General General	4	Functional	Storm Sewer: Piping under Rouge River has light debris under the flow.	*Conduct flushing of the system piping. The cost of this is included in item SSRR-001.*	$0.00
SSRR-006	General General	4	Functional	Sewer backup has been experienced in the African Savannah area where 2 - 8" sanitary lines come together in 1 - 12".	*Since camera inspection showed no blockage and only light deposits of debris, it is concluded that the problem arises from a system design deficiency. Retain the services of a qualified engineer to design corrective measures. The solution will involve excavation and replacement of the joints with new pipes to meet current design standard. The budget includes cost of design and construction.*	$10,000.00
SSRR-007	General General	5	Functional	Manholes were not clearly identified in the field.	*Identity manholes in the field to match numbers on drawings. Add numbering to drawings.*	$2,000.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
SSRR-008	General General	4	Functional	A camera survey of the sanitary sewers was conducted covering approximately 5% of the sewer lines. The survey revealed a significant level of deficiencies including ponding, debris buildup. At one location, the camera was blocked as result of the debris. The following are specific observations as they are listed (a) The sewer lines between North of Gate D to South of Gate D - ponding and debris was observed in the line. Heavy calcite was also observed below a service connection. (b) The sewer lines between South of Gate D to 2nd Manhole South of Gate D - light ponding was noted in the lines. (c) Between 2nd Manhole South of Gate D to 3rd. Manhole South of Gate D - A manhole lid was noted in the manhole. Light ponding was noted. (d) Between 1st manhole west of Eurasia pavilion and north of North American Pavilion - light debris and moerate ponding was noted in the line. (e) Between 1 st manhole west of Eurasia Pavilion and ending at Eurasia Pavilion - light ponding and moderate debris in the line. (f) Between south of the Savana Rest. And north east of manhole 10 -- the camera was blocked by heavy gravel. (g) Between south of the VAS Rest. And west of manhole 10 -- the camera was blocked by debris. Light ponding was also noted. (h) Between south east of the Africa Pav. And east entrace of Africa Pav. - camera was blocked by debris. (I) Between south eastcorner of the elephant house and south west corner of the African Pav. - camera was blocked by debris. (j) Between south west corner of the Africa Pavilion and south west corner of the Elephant House - debris and moderate ponding was noted in the line. (k) Between south west corner of the Africa Pav. And 1st manhole of the north manhole 16, the camera was blocked by debris (l) Between 1st manhole west of the Camel Pen. And 2nd manhole west of the Camel Pen. - Moderate debris in the line.	*The deficiencies noted above revealed three major types of problems namely; heavy to moderate debris in the lines, ponding and calcite formation. Out of the 18 runs observed, only in 4 of the runs were the lines found to be in good condition. Fourteen of the eighteen runs indicated some form of deficiency. Given that only approximately 5% of the entire sanitary sewer lines were inspected, it can be resonably concluded that the other lines which were not viewed will suffer from similar deficiencies to the same degree. In order to rectify these deficiencies, it is recommended that the camera survey be conducted throughout the sanitary lines at a cost of $15000. Following the survey, all areas usffering from light, moderate to heavy debris should be flushed. We estimate the cost of flusing the entire system to be approximately $30,000. The problem of ponding will partly be addressed after flushing where the ponding is the result of debris blockage. However, in some cases, the ponding may be the result of settlement of the pipe. The most appropriate solution to such deficiency will be to excavate the section suffering fromt his problem, raise the pipe and restore the subsoil structure. This solution is very costly and is of limited merit. For the most part, flusing is adequate to ensure proper flow. The third major deficiency was the formation of calcite in the lines. The solution to this problem is to conduct scrubbing, reaming and grouting the joints which are most prone to calcite. All locations where this problem occur will be shown in the camera survey. We estimate a cost of approximately $20,000 for this solution.*	$65,000.00
SSRR-009	General General	5	Functional	A camera survey of the sanitary sewers was conducted covering approximately 5% of the sewer lines. The survey revealed a significant level of deficiencies including ponding, debris buildup. At one location, the camera was blocked as result of the debris. The following are specific observations as they are listed (a) The sewer lines between 3rd manhole west of the Camel Pen and 4th manhole west of the Camel Pen - The drawing of the Sewer run is not correct. Sewer run does not run to manhole number 8 as shown.	*Determine sewer run and termination and record on the drawings.*	$600.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
CSRR-001	General General	**0**	Functional	At the time of this inspection and audit, no failure of either equipment or service cables were observed or reported.	*No action required.*	$0.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
GSRR-003	General General	5	Functional	Random sampling of the gas regulators and valves revealed that they are not providing adequate pressure. It is concluded that the majority of the gas regulators will suffer similar deficiencies.	*Retain a serviceman to check all the regulators, valves and accessories and adjust these components as required.*	$5,000.00

$338,150.00

ID	Location	Pty	Category	Description	Action	Units	Quantity	Budget Cost	Norm Life	Age	Rem. Life	First Occ	Succ Occ
ELCA-004	General General	3	Functional	Underground Service Cable	Replace underground cable between North Service to Americas	LM	4000	$50,000	50	27	0	2000	2050
ELCA-005	General General	6	Functional	Light Standards	Replace Light Standards - 6% every 5 years.	each	33	$6,000	30	27	2	2002	2007
ELCA-006	General General	6	Functional	Transformer Vault	Repair Transformer Vault -20% every 10 years	each	27	$15,000	75	27	10	2010	2020
ELCA-007	General General	6	Functional	Electrical Panels	Replace 30% of elec. Panels every 5 years.	each	3	$5,000	20	27	2	2002	2007
ELCA-008	General General	6	Functional	Transformers	Replace transf. 4 every 2 years	each	49	$25,000	30	27	0	2000	2002
ELCA-009	General General	6	Maintenance	Underground Power Cables	Replace underground power cables between Americas & Africa Pav.	LF	4000	$100,000	50	30	1	2001	2051
ELCA-010	General General	6	Functional	Underground power cable	Replace underground power cable between Africa and Indo Pav.	LF	1500	$37,500	50	30	2	2002	2052
ELCA-011	General General	6	Functional	Underground power cables	Replace underground power cables between Indo Pav. To Front Entrance	LF	2500	$62,500	50	30	3	2003	2053
ELCA-012	General General	6	Functional	Underground power cables	Replace underground power cables between Front Entrance & Australasia Pav.	LF	2000	$50,000	50	30	4	2004	2054
ELCA-013	General General	6	Functional	Underground power cables	Replace underground power cables between Australasia to North service Pav.	LF	3000	$75,000	50	30	5	2005	2055

ID	Location	Pty	Category	Description	Action	Units	Quantity	Budget Cost	Norm Life	Age	Rem. Life	First Occ	Succ Occ
WSCA-002	General General	6	Functional	Valves -Water System	Replace 20% of water valves every 4 years.	each	199	$80,000	10	27	4	2004	2008
WSCA-003	General General	6	Functional	Drinking Fountains-Water System	Replace 20%. Of druinking fountains every 5 years	each	18	$1,200	10	20	5	2005	2010
WSCA-004	General General	6	Functional	Manholes - Water System.	Replace 30%. Of manholes in 15 years	each	5	$24,000	50	27	15	2015	2030
WSCA-005	General General	6	Functional	Pumping Station	Replace pumping station in 5 years	each	1	$30,000	20	27	5	2005	2025
WSCA-006	General General	6	Functional	Water Main Chamber	Repairs to 20% water main chamber in 15 yrs	each	1	$10,000	50	27	15	2015	2035
WSCA-007	General General	6	Functional	Buried Water Pipe	Replace 100 feet of water mains every 2 yrs.	LM	12750	$20,000	50	27	2	2002	2004

ID	Location	Pty	Category	Description	Action	Units	Quantity	Budget Cost	Norm Life	Age	Rem. Life	First Occ	Succ Occ
SSCA-001	General General	6	Functional	Pipe & Fittings	Replace pipes - 6 m every 5 yrs.	LM	19500	$10,000	75	27	5	2005	2010
SSCA-002	General General	6	Functional	Pumping Station	Replace pumping station in 10 yrs.	Each	329	$80,000	20	27	10	2010	2030
SSCA-003	General General	6	Functional	Manholes - Sewer System	Repair 50% of manholes in 15 yrs.	Each	329	$50,000	50	27	15	2015	2065
SSCA-005	General General	6	Functional	General	Replace 100% of area drains in 13 yrs	Each	7	$7,000	40	27	13	2013	2000
SSCA-007	General General	6	Functional	Pumping Station	Replace in 10 years.	each	329	$80,000	20	27	10	2010	2020
SSCA-008	General General	6	Functional	Manholes - Storm System.	Replace 50%. Of manholes in 15 yrs	each	329	$30,000	50	27	15	2015	2030
SSCA-010	General General	6	Functional	Catch Basins - Storm System.	Replace 50%. Of Catch Basins in 15 yrs	each	275	$30,000	50	27	15	2015	2065

ID	Location	Pty	Category	Description	Action	Units	Quantity	Budget Cost	Norm Life	Age	Rem. Life	First Occ	Succ Occ
CSCA-002	General General	6	Functional	General	Allowance for equip. technology unpgrade	LM	1	$15,000	15	4	10	2010	2030
CSCA-003	General General	6	Functional	General	Replace undergrd cable	LM	12000	$7,500	50	27	23	2023	2050
CSCA-004	General General	6	Functional	Underground Cables	Underground communication cables between North Service to Americas Pavilions.	LF	2000	$10,000	50	30	0	2000	2050
CSCA-005	General General	6	Functional	Undergound Communication Cables	Underground communication cables between Americas to Africa Pavilions.	LF	4000	$12,000	50	30	1	2001	2051
CSCA-006	General General	6	Functional	Underground Communication Cables	Underground communication cables between Africa to Indo Pavilions.	LF	1500	$7,500	50	30	2	2002	2052
CSCA-007	General General	6	Functional	Underground Communication Cables	Underground communication cables between Indo Pavilion to Front Entrance.	LF	2500	$10,000	50	30	3	2003	2053
CSCA-008	General General	6	Functional	Underground Communication Cables	Underground communication cables between Front Entrance to Australisia Pavilions.	LF	2000	$9,000	50	30	4	2004	2054
CSCA-009	General General	6	Functional	Underground Communication Cables	Underground communication cables between Australasia to North Service Pavilions.	LF	3000	$11,000	50	30	5	2005	2055

ID	Location	Pty	Category	Description	Action	Units	Quantity	Budget Cost	Norm Life	Age	Rem. Life	First Occ	Succ Occ
GSCA-001	General General	6	Functional	Valves	Repair Gas system valves - 20% every 2 years	each	4	$1,000	20	20	2	2002	2004
GSCA-002	General General	6	Functional	Gas pipes and fittings	Repair gas/fittings - 6 m every two year	LM	4150	$3,000	75	27	1	2001	2003
GSCA-003	General General	6	Functional	Regulators and Meters	Repair regulators/memters - 20% every 5 years	each	30	$12,000	25	20	5	2005	2005

Recommendation Report

Preventive Maintenance **Toronto Zoo**

WATER SYSTEM

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
WSPM-001	General General	4	Life Safety	Fire Hydrants -Overhauling Servicing	*The fire hydrants require overhauling and servicing to maintain all operating parts. Allow for the servicing and overhauling of the fire hydrants once every 5 years at an annual cost of $ 1100.00*	$5,500.00
WSPM-002	General General	4	Life Safety	Fire Hydrants: Fire Flow tests	*Conduct annual flow test to check the water pressure and performance of the hydrants on site. Allow an annual budget of $5800.*	$5,800.00
WSPM-003	General General	4	Life Safety	Fire Hydrants: Leak Detection Tests	*The fire hydrants on site require a leak detection test to be performed on them to determine if there are any defective parts in its assembly. Allow an annual budget of $5800.*	$5,800.00
WSPM-004	General General	6	Maintenance	Manholes, valve and meter chambers. All site services including manholes, vlave chambers and meters require annual cleaning and inspection.	*Conduct annual inspection and cleaning of all these components on site. Allow an annual budget of $4000.*	$4,000.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
SSPM-001	General General	6	Maintenance	Catch Basins, Manholes and Area Drains. These site services components require annual cleaning to clear them of dirt and debrits.	*Flush these services components once every year. Allow annual budget of $12000.*	$12,000.00
SSPM-002	General General	6	Maintenance	Manholes. Thses site services components require annual cleaning to clear them of dirt and debrits.	*Flush these services components once every year. Allow annual budget of $10000.*	$10,000.00
SSPM-003	General General	6	Maintenance	Buried Pipes. A camera survey is required in order to check the integrity of the underground pipes. This survey is recommended to be performed every 10 years.	*Conduct a camera survey of the storm sewer lines every 10 years. Allow an annual budget of $ 1000.00*	$1,000.00
SSPM-004	General General	6	Maintenance	Buried Pipes. A camera survey is required in order to check the integrity of the underground pipes. This survey is recommended to be performed every 10 years.	*Conduct a camera survey of the sanitary sewer lines every 10 years. Allow an annual budget of $ 1500.00*	$1,500.00

ID	Location	Pty	Category	Description	Correction	Base Year Budget Cost
GSPM-001	General General	6	Maintenance	Gas Lines and Valves. Gas lines, meters, and valves require to be inspected periodically to check for signs of leaks, corrosion etc.	*Retain the services of Consumer Gas or its approved contractor to inspect the gas lines and associated components annually. All equipment on site using gas should be included in this annual inspection. All such appliances should be cleaned to ensure proper gas supply. Allow an annual budget of $ 1000.00.*	$10,000.00

$55,600.00

APPENDIX 4

1997 ENERGY REPORT

TORONTO

1997 Energy Report

Toronto Zoo

All Facilities

Corporate Services
Energy Management Office, 392-8954

CITY OF TORONTO

1997 Energy Report

TORONTO ZOO

CONTENTS

CITY OF TORONTO
TORONTO ZOO

ALL FACILITIES

1997 Actual Energy CONSUMPTION & COST vs Adjusted Baseline

EXECUTIVE SUMMARY

ENERGY TYPE		ENERGY CONSUMPTION				ENERGY COST			
Name & Unit		Adj.Base 1995	Actual 1997	Energy Change	Percent Change	Adj.Base 1995	Actual 1997	Cost Change	Percent Change
Electricity	kWh	10,206,299	10,171,317	(34,982)	-0.3%	$732,724	$727,829	($4,895)	-0.7%
Natural Gas	m^3	1,802,733	2,011,432	208,699	11.6%	$263,690	$296,334	$32,644	12.4%
Heating Oil	litre	13,458	9,228	(4,230)	-31.4%	$4,433	$3,058	($1,376)	-31.0%
Gasoline	litre	61,427	59,577	(1,850)	-3.0%	$34,107	$33,120	($988)	-2.9%
Diesel	litre	22,362	28,759	6,397	28.6%	$10,132	$13,077	$2,946	29.1%
Propane	litre	50,973	61,645	10,671	20.9%	$17,988	$21,650	$3,663	20.4%
Water	m^3	28,849,623	30,972,943	2,123,321	7.4%	$220,768	$260,329	$39,561	17.9%
Total	ekWh	30,208,091	32,417,110	2,209,019	**7.3%**	$1,283,842	$1,355,396	**$71,554**	**5.6%**

NOTE:

1) Adj.Base - The 1995 energy consumption and cost are adjusted to the 1997 billing periods, weather conditions and energy costs.

2) Actual - The current year (1997) actual energy consumption and cost.

3) ekWh - equivalent kilowatt-hour; water consumption is not included in total energy.

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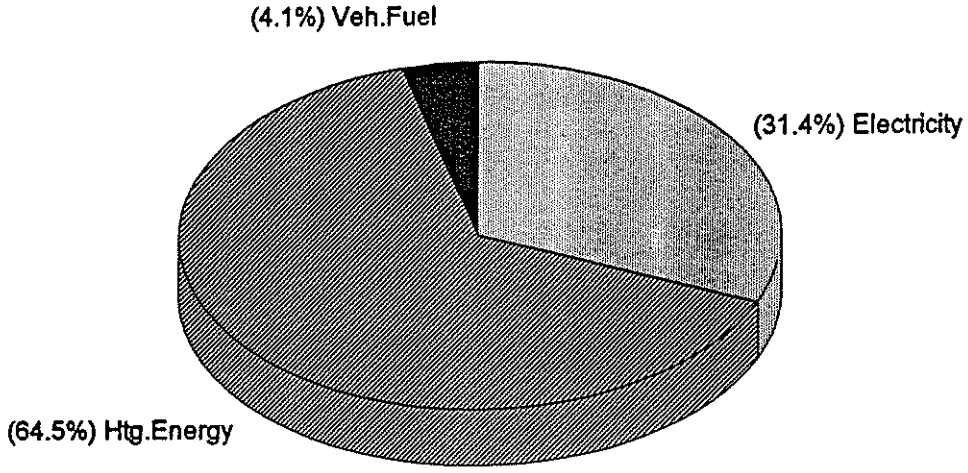
CITY OF TORONTO
TORONTO ZOO

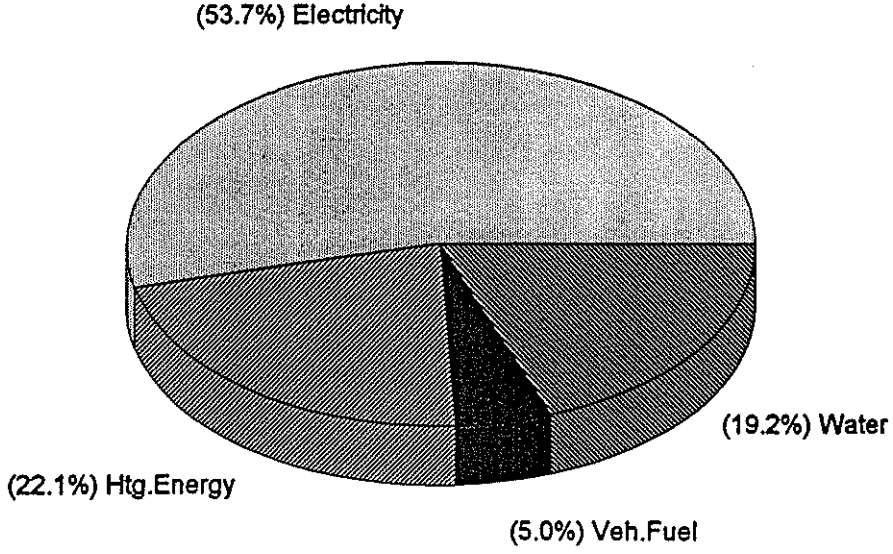
ALL FACILITIES
1997 Actual ENERGY CONSUMPTION & COST

Energy Consumption



Total 32,417.1 equivalent megawatt hours
Total 7,375 tonnes CO2

Energy Cost



Total $1,355.4 millions

NOTE: Htg Energy includes natural gas & heating oil; Veh.Fuel includes gasoline, diesel and propane.

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CITY OF TORONTO
TORONTO ZOO

MASTER METERS

1997 Actual ENERGY CONSUMPTION VS Adjusted Baseline

FACILITIES		ELECTRICITY (kWh)			NATURAL GAS (m³)			WATER (m³)			TOTAL (ekWh)		
Facility ID	and Name	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change
DR	Domain Ride & Garage Bldg	188,060	152,460	-18.9%	—	—	—	—	—	—	188,060	152,460	-18.9%
FB	Finch Barn	52,079	9,120	-82.5%	—	—	—	—	—	—	52,079	9,120	-82.5%
GHS	Gate House	14,867	9,068	-39.0%	—	—	—	—	—	—	14,867	9,068	-39.0%
MB	Main Barn	227,027	207,600	-8.6%	—	—	—	—	—	—	227,027	207,600	-8.6%
ZMM	Zoo Main Meter	9,664,589	9,730,005	0.7%	1,802,733	2,011,432	11.6%	273,371	330,480	20.9%	28,307,913	30,531,631	7.9%
VH	Valley Halla	25,828	19,096	-26.1%	—	—	—	—	—	—	25,828	19,096	-26.1%
ZPS	Zoo Police Stable	33,849	43,968	29.9%	—	—	—	—	—	—	33,849	43,968	29.9%
Total		10,206,299	10,171,317	-0.3%	1,802,733	2,011,432	11.6%	273,371	330,480	20.9%	28,849,623	30,972,943	7.4%

MASTER METERS

1997 Actual ENERGY COST VS Adjusted Baseline

FACILITIES		ELECTRICITY COST			NATURAL GAS COST			WATER COST			TOTAL COST		
Facility ID	and Name	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change
DR	Domain Ride & Garage Bldg	$15,094	$12,342	-18.2%	—	—	—	—	—	—	$15,094	$12,342	-18.2%
FB	Finch Barn	$4,965	$833	-83.2%	—	—	—	—	—	—	$4,965	$833	-83.2%
GHS	Gate House	$1,387	$850	-38.8%	—	—	—	—	—	—	$1,387	$850	-38.8%
MB	Main Barn	$18,617	$16,130	-13.4%	—	—	—	—	—	—	$18,617	$16,130	-13.4%
ZMM	Zoo Main Meter	$687,572	$692,323	0.7%	$263,690	$296,334	12.4%	$220,768	$260,329	17.9%	$1,172,030	$1,248,986	6.6%
VH	Valley Halla	$2,245	$1,684	-25.0%	—	—	—	—	—	—	$2,245	$1,684	-25.0%
ZPS	Zoo Police Stable	$2,844	$3,667	28.9%	—	—	—	—	—	—	$2,844	$3,667	28.9%
Total		$732,724	$727,829	-0.7%	$263,690	$296,334	12.4%	$220,768	$260,329	17.9%	$1,217,182	$1,284,492	5.5%

NOTE: Adj.Base - The 1995 energy consumption and cost are adjusted to the 1997 billing periods, weather conditions and energy costs.
Actual - The current year (1997) actual energy consumption and cost.
ekWh - Equivalent kilowatt-hour (1 cubic metre of Natural Gas = 10.3417 ekWh).

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CITY OF TORONTO
TORONTO ZOO

McDONALD RESTAURANTS

1997 Actual ENERGY CONSUMPTION VS Adjusted Baseline

FACILITIES	ELECTRICITY (kWh)			NATURAL GAS (m³)			WATER (m³)			TOTAL (ekWh)		
Facility ID and Name	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change
AR Africa Restaurant	517,885	529,200	2.2%	82,097	73,153	-10.9%	6,979	5,008	-28.2%	1,366,905	1,285,723	-5.9%
ESB Eurasia Snack Bar	28,586	45,360	58.7%	—	—	—	899	469	-47.8%	28,586	45,360	58.7%
MGSB Main Gate Snack Bar	—	2,800	—	—	—	—	1,152	1,269	10.2%	—	2,800	—
MSB Madagascar Snack Bar	72,275	73,440	1.6%	—	—	—	928	700	-24.6%	72,275	73,440	1.6%
NAR North America Restaurant	290,282	321,200	10.7%	32,612	43,743	34.1%	7,917	7,649	-3.4%	627,548	773,579	23.3%
Total		972,000			116,896			15,095			2,180,902	
Total (excl. energy added after 1995)	909,028	969,200	**6.6%**	114,709	116,896	**1.9%**	17,875	15,095	**-15.6%**	2,095,314	2,178,102	**4.0%**

McDONALD RESTAURANTS

1997 Actual ENERGY COST VS Adjusted Baseline

FACILITIES	ELECTRICITY COST			NATURAL GAS COST			WATER COST			TOTAL COST		
Facility ID and Name	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change
AR Africa Restaurant	$37,661	$37,911	0.7%	$11,967	$10,570	-11.7%	$5,400	$3,888	-28.0%	$55,028	$52,370	-4.8%
ESB Eurasia Snack Bar	$1,839	$3,222	75.2%	—	—	—	$707	$368	-48.0%	$2,546	$3,590	41.0%
MGSB Main Gate Snack Bar	—	$213	—	—	—	—	$896	$987	10.2%	—	$1,201	—
MSB Madagascar Snack Bar	$5,049	$5,169	2.4%	—	—	—	$721	$553	-23.3%	$5,770	$5,722	-0.8%
NAR North America Restaurant	$21,021	$22,863	8.8%	$4,648	$6,395	37.6%	$6,148	$5,899	-4.0%	$31,817	$35,157	10.5%
Total		$69,379			$16,965			$11,695			$98,039	
Total (excl. energy added after 1995)	$65,570	$69,166	**5.5%**	$16,615	$16,965	**2.1%**	$13,871	$11,695	**-15.7%**	$95,161	$96,839	**1.8%**

NOTE: **Adj.Base** - The 1995 energy consumption and cost are adjusted to the 1997 billing periods, weather conditions and energy costs.
Actual - The current year (1997) actual energy consumption and cost.
ekWh - Equivalent kilowatt-hour (1 cubic metre of Natural Gas = 10.3417 ekWh).

CITY OF TORONTO
TORONTO ZOO

SUBMETERS

1997 Actual ENERGY CONSUMPTION VS Adjusted Baseline

FACILITIES		ELECTRICITY (kWh)			NATURAL GAS (m³)			WATER (m³)			TOTAL (ekWh)		
Facility ID	and Name	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change
AFP	African Pavilion	—	1,225,207	—	434,394	487,994	12.3%	—	—	—	—	6,271,892	—
AFR	Africa Rhino / Mixed Hoofstock	—	—	—	—	3,038	—	—	—	—	—	31,418	—
AMP	Americas Pavilion	—	519,028	—	112,177	130,520	16.4%	—	—	—	—	1,868,824	—
APN	Australasian Pavilion Nocturnal	—	—	—	2,601	2,355	-9.5%	—	—	—	26,898	24,351	-9.5%
AUP	Australasian Pavilion	—	395,717	—	122,204	143,968	17.8%	—	—	—	—	1,884,589	—
BBH	Baboon House	—	—	—	—	2,029	—	—	—	—	—	20,983	—
CHH	Cheetah House	—	—	—	—	1,011	—	—	—	—	—	10,455	—
CL	Caracal Lynx	—	—	—	—	2,207	—	—	—	—	—	22,824	—
DR	Domain Ride & Garage Bldg	—	—	—	43,209	34,753	-19.6%	—	—	—	446,849	359,400	-19.6%
EH	Elephants House	—	—	—	17,159	33,737	96.6%	—	—	—	177,456	348,902	96.6%
FC	Family Centre	—	—	—	4,778	4,568	-4.4%	—	—	—	49,410	47,237	-4.4%
GGS	Greenhouse Gift Shop	—	—	—	—	16,507	—	—	—	—	—	170,710	—
GH	Giraffe House	—	—	—	9,789	10,876	11.1%	—	—	—	101,234	112,473	11.1%
GHG	Gorilla Holding	—	—	—	14,984	9,219	-38.5%	—	—	—	154,958	95,340	-38.5%
GKB	Groundskeeping Building	—	—	—	52,521	68,884	31.2%	—	813	—	543,151	712,374	31.2%
HPH	Hippo House	—	—	—	58,434	74,902	28.2%	—	—	—	604,305	774,610	28.2%
IMP	Indo-Malayan Pavilion	—	643,067	—	242,524	253,206	4.4%	—	—	—	—	3,261,644	—
IRB	Indian Rhino Building	—	—	—	67,270	50,214	-25.4%	—	—	—	695,691	519,293	-25.4%
LH	Lion House	—	—	—	—	1,055	—	—	—	—	—	10,910	—
LHH	Lion House (Hyena)	—	—	—	—	7,836	—	—	—	—	—	81,038	—
MHS	Mixed Hoofstock	—	—	—	—	10,720	—	—	—	—	—	110,863	—
MT	Mayan Temple	—	—	—	—	17,938	—	—	—	—	—	185,509	—
MW	Malayan Wood (Village Edge)	—	—	—	39,680	40,334	1.6%	—	—	—	410,364	417,119	1.6%
NSB	North Services Building	—	—	—	386,110	410,429	6.3%	—	9,330	—	—	4,244,537	—
OAB	Old Administrative Building	—	258,174	—	24,578	27,474	11.8%	—	—	—	—	542,298	—
OH	Orangutan Holding	—	—	—	15,911	17,874	12.3%	—	—	—	164,551	184,851	12.3%
PBH	Polar Bear Holding	—	—	—	—	4,696	—	—	—	—	—	48,565	—
ZSB	Zoological Society Building	275,229	279,597	1.6%	7,280	4,912	-32.5%	2,225	1,459	-34.5%	350,516	330,397	-5.7%
Total			3,320,790			1,873,253			11,602			22,693,406	
Total (excl. energy added after 1995)		275,229	279,597	**1.6%**	1,655,603	1,806,216	**9.1%**	2,225	1,459	**-34.5%**	3,725,384	3,926,346	**5.4%**

NOTE: Adj.Base - The 1995 energy consumption and cost are adjusted to the 1997 billing periods, weather conditions and energy costs.
Actual - The current year (1997) actual energy consumption and cost.
ekWh - Equivalent kilowatt-hour (1 cubic metre of Natural Gas = 10.3417 ekWh).

Prepared By: City of Toronto, Corporate Services, Energy Management Office .....Date: 98/2/27 .....File: g:\energy\mz\sva97mz.wk4, SubMtrUse

CITY OF TORONTO
TORONTO ZOO

SUBMETERS

1997 Actual ENERGY COST VS Adjusted Baseline

FACILITIES		ELECTRICITY COST			NATURAL GAS COST			WATER COST			TOTAL COST		
Facility ID	and Name	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change	Adj.Base 1995	Actual 1997	Percent Change
AFP	African Pavilion	—	$87,411	—	$64,607	$72,869	12.8%	—	—	—	—	$160,280	—
AFR	Africa Rhino / Mixed Hoofstock	—	—	—	—	$439	—	—	—	—	—	$439	—
AMP	Americas Pavilion	—	$36,876	—	$16,748	$19,526	16.6%	—	—	—	—	$56,401	—
APN	Australasian Pavilion Nocturnal	—	—	—	$390	$356	-8.6%	—	—	—	$390	$356	-8.6%
AUP	Australasian Pavilion	—	$28,071	—	$18,244	$21,676	18.8%	—	—	—	—	$49,747	—
BBH	Baboon House	—	—	—	—	$313	—	—	—	—	—	$313	—
CHH	Cheetah House	—	—	—	—	$146	—	—	—	—	—	$146	—
CL	Caracal Lynx	—	—	—	—	$329	—	—	—	—	—	$329	—
DR	Domain Ride & Garage Bldg	—	—	—	$6,496	$5,221	-19.6%	—	—	—	$6,496	$5,221	-19.6%
EH	Elephants House	—	—	—	$2,552	$5,057	98.2%	—	—	—	$2,552	$5,057	98.2%
FC	Family Centre	—	—	—	$713	$684	-4.1%	—	—	—	$713	$684	-4.1%
GGS	Greenhouse Gift Shop	—	—	—	—	$2,481	—	—	—	—	—	$2,481	—
GH	Giraffe House	—	—	—	$1,469	$1,639	11.6%	—	—	—	$1,469	$1,639	11.6%
GHG	Gorilla Holding	—	—	—	$2,205	$1,346	-39.0%	—	—	—	$2,205	$1,346	-39.0%
GKB	Groundskeeping Building	—	—	—	$7,882	$10,297	30.6%	—	$662	—	$7,882	$10,297	30.6%
HPH	Hippo House	—	—	—	$8,740	$11,246	28.7%	—	—	—	$8,740	$11,246	28.7%
IMP	Indo-Malayan Pavilion	—	$45,721	—	$36,171	$37,955	4.9%	—	—	—	—	$83,676	—
IRB	Indian Rhino Building	—	—	—	$10,062	$7,539	-25.1%	—	—	—	$10,062	$7,539	-25.1%
LH	Lion House	—	—	—	—	$155	—	—	—	—	—	$155	—
LHH	Lion House (Hyena)	—	—	—	—	$1,166	—	—	—	—	—	$1,166	—
MHS	Mixed Hoofstock	—	—	—	—	$1,594	—	—	—	—	—	$1,594	—
MT	Mayan Temple	—	—	—	—	$2,669	—	—	—	—	—	$2,669	—
MW	Malayan Wood (Village Edge)	—	—	—	$5,915	$6,021	1.8%	—	—	—	$5,915	$6,021	1.8%
NSB	North Services Building	—	—	—	$57,653	$61,302	6.3%	—	$7,383	—	—	$61,302	—
OAB	Old Administrative Building	—	$18,448	—	$3,682	$4,114	11.7%	—	—	—	—	$22,563	—
OH	Orangutan Holding	—	—	—	$2,358	$2,676	13.5%	—	—	—	$2,358	$2,676	13.5%
PBH	Polar Bear Holding	—	—	—	—	$707	—	—	—	—	—	$707	—
ZSB	Zoological Society Building	$19,506	$19,935	2.2%	$1,105	$744	-32.7%	$1,811	$1,186	-34.5%	$22,423	$22,491	0.3%
Total			$236,462			$280,269			$9,231			$518,543	
Total (excl. energy added after 1995)		$19,506	$19,935	**2.2%**	$246,993	$270,269	**9.4%**	$1,811	$1,186	**-34.5%**	$71,206	$74,574	**4.7%**

NOTE: Adj.Base - The 1995 energy consumption and cost are adjusted to the 1997 billing periods, weather conditions and energy costs.
Actual - The current year (1997) actual energy consumption and cost.
ekWh - Equivalent kilowatt-hour (1 cubic metre of Natural Gas = 10.3417 ekWh).

Prepared By: City of Toro... Corporate Services, Energy Management Office .....Date: 98/2/27 .....File: g:\energy\mz\ava97mz.wk4, SubMtrCost

II. MULTI-YEAR ENERGY

QUARTERLY Energy Consumption

ANNUAL Energy Consumption & Cost

CITY OF TORONTO
TORONTO ZOO

MULTI-YEAR QUARTERLY ENERGY CONSUMPTION

(Excluding McDonalds)

ENERGY TYPE		1st QTR	2nd QTR	3rd QTR	4th QTR	TOTAL	Tonnes CO2
1997 ACTUAL CONSUMPTION							
Electricity	kWh	2,690,350	2,109,088	1,929,473	2,470,406	9,199,317	2,451
Natural Gas	m^3	878,934	332,633	99,944	583,025	1,894,536	4,038
Heating Oil	Litre	6,263	1,186	—	1,780	9,229	29
Gasoline	Litre	10,323	21,799	15,442	12,013	59,577	158
Diesel Oil	Litre	6,195	—	10,976	11,588	28,759	84
Propane	Litre	13,520	14,065	23,846	10,213	61,644	88
Water	m^3	31,001	71,204	62,328	150,851	315,384	—
Total	**ekWh**	**12,114,729**	**5,877,212**	**3,408,673**	**8,835,589**	**30,236,204**	**6,848**
Tonnes of CO2		**2,674**	**1,353**	**834**	**1,987**	**6,848**	**6,848**
1996 ACTUAL CONSUMPTION							
Electricity	kWh	3,067,791	2,054,795	1,755,495	2,267,879	9,145,960	2,436
Natural Gas	m^3	838,667	340,400	81,583	545,239	1,805,889	3,849
Heating Oil	Litre	17,992	4,467	—	4,723	27,182	85
Gasoline	Litre	15,894	15,481	16,869	15,702	63,946	170
Diesel Oil	Litre	6,263	3,922	5,841	4,993	21,019	62
Propane	Litre	16,309	13,028	17,639	10,613	57,589	83
Water	m^3	45,737	15,462	164,268	70,351	295,818	—
Total	**ekWh**	**12,277,030**	**5,912,019**	**2,956,743**	**8,241,665**	**29,387,456**	**6,684**
Tonnes of CO2		**2,745**	**1,358**	**729**	**1,853**	**6,684**	**6,684**
1995 ACTUAL CONSUMPTION							
Electricity	kWh	2,780,268	2,103,835	2,004,690	2,394,446	9,283,239	2,473
Natural Gas	m^3	706,538	325,526	92,599	496,452	1,621,115	3,455
Heating Oil	Litre	15,155	5,943	—	—	21,098	66
Gasoline	Litre	15,502	15,781	15,325	14,819	61,427	163
Diesel Oil	Litre	3,584	6,761	6,132	5,885	22,362	66
Propane	Litre	13,874	12,555	13,980	10,564	50,973	73
Water	m^3	45,009	122,815	119,911	63,195	350,929	—
Total	**ekWh**	**10,541,764**	**5,852,858**	**3,280,598**	**7,813,654**	**27,488,875**	**6,296**
Tonnes of CO2		**2,365**	**1,353**	**810**	**1,768**	**6,296**	**6,296**
1994 ACTUAL CONSUMPTION							
Electricity	kWh	2,635,799	1,751,056	1,552,095	2,173,911	8,112,861	2,161
Natural Gas	m^3	676,728	243,540	87,864	418,476	1,426,608	3,040
Heating Oil	Litre	12,075	5,180	1,126	6,947	25,328	79
Gasoline	Litre	—	22,998	11,000	18,003	52,001	138
Diesel Oil	Litre	—	7,993	—	9,000	16,993	50
Propane	Litre	17,402	19,829	25,001	21,501	83,733	120
Water	m^3	38,327	59,814	36,391	133,259	267,791	—
Total	**ekWh**	**9,895,054**	**4,781,337**	**2,766,781**	**7,007,689**	**24,450,862**	**5,589**
Tonnes of CO2		**2,207**	**1,115**	**669**	**1,598**	**5,589**	**5,589**

NOTE: Energy data has not been normalized to billing period nor weather conditions. Water is not included in total energy and CO2.

Prepared By: City of Toronto, Corporate Services, Energy Management Office .....Date: 98/2/27 .....File: g:\energy\mr\qtrmr.wk4

02-26-1998

FASER ENERGY ACCOUNTING SYSTEM
CITY OF TORONTO

TORONTO ZOO
Cost Centre: ZOO FACILITIES
Energy: ALL ENERGY TYPES
Program: MULTIYEAR - ACTUAL ENERGY
Report: COST CENTRE SUMMARY

FACILITY ENERGY TYPE NAME		1995 USE	1995 COST	1996 USE	1996 COST	1997 USE	1997 COST
ALL FACILITIES							
ELECTRICITY	(KWH)	10,256,879	$769,549	10,109,360	$750,680	10,171,317	$727,829
DEMAND	(KW)	20,183		19,143		19,031	
NATURAL GAS	(M3)	1,732,519	$260,243	1,938,654	$287,390	2,011,432	$296,334
HEATING OIL	(L)	21,099	$4,947	27,182	$7,208	9,228	$3,058
GASOLINE	(L)	61,427	$31,758	63,946	$33,060	59,577	$33,120
DIESEL OIL	(L)	22,362	$9,750	21,018	$9,164	28,759	$13,07
PROPANE	(L)	50,973	$15,751	57,589	$20,924	61,645	$21,65
WATER	(M3)	368,635	$274,177	306,823	$245,629	330,480	$260,32
TOTAL	(EKWH)	29,614,634	$1,366,175	31,723,864	$1,354,054	32,417,110	$1,355,39

NOTE: Energy data has not been normalized to billing period nor weather conditions.

02-26-1998

FASER ENERGY ACCOUNTING SYSTEM
CITY OF TORONTO

TORONTO ZOO
Cost Centre: MCDONALDS RESTAURANT
Energy: ALL ENERGY TYPES
Program: MULTIYEAR - ACTUAL ENERGY
Report: COST CENTRE SUMMARY

FACILITY ENERGY TYPE NAME		1995 USE	1995 COST	1996 USE	1996 COST	1997 USE	1997 COST
ALL FACILITIES							
ELECTRICITY	(KWH)	973,640	$81,680	963,400	$78,635	972,000	$69,379
DEMAND	(KW)	3,256		2,952		3,345	
NATURAL GAS	(M3)	111,404	$16,795	134,331	$19,703	116,896	$16,965
WATER	(M3)	17,683	$13,534	11,102	$8,691	15,095	$11,695
TOTAL	(EKWH)	2,125,746	$112,009	2,352,612	$107,028	2,180,903	$98,039

NOTE: Energy data has not been normalized to billing period nor weather conditions.

APPENDIX 5

GT WOOD – HIGH VOLTAGE MAINTENANCE REPORT DATED 1995

G.T. WOOD CO. LTD.

3354 Mavis Rd. Mississauga, Ont. L5C 1T8
TEL: (905) 272-1696 Fax: (905) 272-1425

February 28, 1995

METRO TORONTO ZOO
P.O. Box 280,
West Hill, Ontario,
M1E 4R5

ATTN: Mr. Dean Evans

RE: Your PO #12124
Our Ref #9951

Dear Sir;

In accordance with your request, we have completed the Inspection and Testing of the substation and associated electrical equipment at the above location.

Please find enclosed our test report for your reference.

Thank you for the favour of this business.

Yours very truly,
G.T. WOOD COMPANY LIMITED

L.A. Snow
LAS/jn

Encl.
RSCL/1

G.I. WOOD CO. LTD.

METRO TORONTO ZOO
WEST HILL
ATTN: MR. DEAN EVANS

REFERENCE NO.: 9951
DECEMBER 1994

GENERAL SHEET

MAIN OUTDOOR SUBSTATION - SHEETS #1 - #3

- ~~The substation fence requires replacement.~~
- The primary switchgear is showing signs of rust. The entire enclosure requires repainting and recaulking.
- The insulation resistance of the lighting arrestors on the entrance pole was found as follows:

  Red Phase - 32 Megohms
  Yellow Phase - 45 Megohms
  Blue Phase - 40 Megohms

  The above values show internal deterioration. Replacement units are required.

SHEET #1

- The interphase barriers are showing signs of deterioration. Replacements are required.
- Two (2) of three (3) interrupting units are defective. Replacements are required.
- ~~Two (2) potential indicators were found defective. Replacements were supplied and installed~~.

SHEET #2

- The arc blades are missing from this switch. New units are required.
- The interphase barriers are showing signs of deterioration. Replacements are required.
- One (1) potential indicator was found defective. A new unit was supplied and installed.
- ~~A new heater was installed.~~

SHEET #3

- The interphase barriers are showing signs of deterioration. Replacements are required.
- ~~A new heater was installed~~

continued

G.T. WOOD CO. LTD.

METRO TORONTO ZOO
YOUR PO #12124
OUR REF #9951

A B B
A BROWN BOBAY

SOCIETY BUILDING
- All equipment was found to be satisfactory.

INDO-MALAYA PAVILION - SHEETS #11 & #12
- The overload devices on both air circuit breakers are leaking fluid. We recommend replacing these liquid filled overload devices with solid state units.
- The base of the secondary switchboard is rusting. Repainting is required. ?

EURASIA PAVILION - SHEET #18
- The switch handle for this feeder is defective. Replacement is required.

AFRICA PAVILION - SHEETS #30 & #31
- The overload devices on both air circuit breakers are leaking fluid. We recommend replacing these liquid filled overload devices with solid state units.
- A draw-out handle is required for the breakers

NORTH AMERICA PAVILION
- All electrical equipment was found to be satisfactory.

ENT. FACILITIES - SHEET #43
- The interrupter units for this switch require replacement.

VAULT TYPE TRANSFORMERS
- All transformers and vaults were serviced and left in satisfactory condition. The liquid from each transformer was analyzed for 4 part standard test. Please see the attached test report for results.

G.I. WOOD CO. LTD.

STANDARD OIL TEST SHEET

CUSTOMER: TORONTO METRO ZOO **REF NO.:** 9951

LOCATION: WEST HILL, ONTARIO

****

The following standards are applicable for transformer oil tests.

It is recommended a sample be tested every 12 months.

DIELECTRIC: (Kilo Volt breakdown A. S. T. M. Standard) For safe and satisfactory operation, this should not be below 25 Kilo Volts.

ACID: Neutralization Number mg. KOH/g. New oil has a Neutralization Number of approximately .03. As this value increases, oxidation and final sludging is progressively indicated.

INTERFACIAL TENSION: (I.F.T. Dynes/CM) New oil has an I.F.T. of 35 - 40 Dynes. This drops very rapidly in early stages of contamination, but serious contamination is not indicated until a value of approximately 14 - 17 dynes is reached.

COLOUR: New oil has a colour value of approximately No. 1. A change in colour indicates contamination and has value in final evaluation of oil condition.

TEST RESULTS WERE AS FOLLOWS;

SERIAL NO.	NEUT NO.	COLOUR	IFT	DIELECTRIC
Vault #28				
871934	.02	1	42.7	46
871931	.01	1	43.2	25
Vault #1				
871935	.02	1	42.7	35
Vault #26				
861962	.02	1	41.8	42
Vault #33				
861942	.02	1	44.0	30
Vault #29				
861972	.01	1	43.0	34
861964	.01	1	40.2	38
Vault #21				
861981	.02	1	39.1	25
871926	.01	1	39.0	31
Vault #20				
861944	.02	1	39.8	36
871937	.01	1	39.0	33

//

G.I. WOOD CO. LTD.

STANDARD OIL TEST SHEET

CUSTOMER: TORONTO METRO ZOO **REF NO.:** 9951

LOCATION: WEST HILL, ONTARIO

****

The following standards are applicable for transformer oil tests.

It is recommended a sample be tested every 12 months.

DIELECTRIC: (Kilo Volt breakdown A. S. T. M. Standard) For safe and satisfactory operation, this should not be below 25 Kilo Volts.

ACID: Neutralization Number mg. KOH/g. New oil has a Neutralization Number of approximately .03. As this value increases, oxidation and final sludging is progressively indicated.

INTERFACIAL TENSION: (I.F.T. Dynes/CM) New oil has an I.F.T. of 35 - 40 Dynes. This drops very rapidly in early stages of contamination, but serious contamination is not indicated until a value of approximately 14 - 17 dynes is reached.

COLOUR: New oil has a colour value of approximately No. 1. A change in colour indicates contamination and has value in final evaluation of oil condition.

TEST RESULTS WERE AS FOLLOWS;

SERIAL NO.	NEUT NO.	COLOUR	IFT	DIELECTRIC
Vault #22				
861973	.02	1	38.4	35
871933	.02	1	38.2	28
861976	.02	1	42.7	33
871932	.01	1	41.9	31
861955	.03	1	42.8	32
861949	.02	1	40.0	35
861952	.02	1	42.6	32
871930	.02	1	41.6	33
861980	.02	1	43.4	37
861975	.01	1	40.7	33
Vault #6				
861979	.01	1	43.6	37
Vault #34				
871936	.01	1	43.0	37
861927	.01	1	44.7	41
861971	.01	1	43.0	50
Vault #13				
861951	.02	1.75	42.7	35
861950	.02	1	44.7	40
861954	.02	1	44.0	46
Vault #13A				
LG37990	.01	1	42.6	41

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G.T. WOOD CO. LTD.

STANDARD OIL TEST SHEET

CUSTOMER: TORONTO METRO ZOO **REF NO.:** 9951

LOCATION: WEST HILL, ONTARIO

****

The following standards are applicable for transformer oil tests.

It is recommended a sample be tested every 12 months.

DIELECTRIC: (Kilo Volt breakdown A. S. T. M. Standard) For safe and satisfactory operation, this should not be below 25 Kilo Volts.

ACID: Neutralization Number mg. KOH/g. New oil has a Neutralization Number of approximately .03. As this value increases, oxidation and final sludging is progressively indicated.

INTERFACIAL TENSION: (I.F.T. Dynes/CM) New oil has an I.F.T. of 35 - 40 Dynes. This drops very rapidly in early stages of contamination, but serious contamination is not indicated until a value of approximately 14 - 17 dynes is reached.

COLOUR: New oil has a colour value of approximately No. 1. A change in colour indicates contamination and has value in final evaluation of oil condition.

TEST RESULTS WERE AS FOLLOWS;

SERIAL NO.	NEUT NO.	COLOUR	IFT	DIELECTRIC
Vault #12				
861963	.01	1	40.6	35
861967	.01	1	43.8	40
861968	.02	1	41.2	36
Vault #35				
871928	.02	1	43.5	42
971929	.01	1	43.9	40
971925	.02	1	44.7	41
Vault #11				
861953	.01	1	42.8	41
Vault #8				
871939	.01	1	42.3	35
Vault #10				
861978	.01	1	44.6	42
861977	.01	1	44.0	44
Vault N/A				
861974	.01	1	44.8	41
Vault N/A				
LG37989	.01	1	44.0	46
Vault N/A				
861966	.02	1	42.1	35

G.I. WOOD CO. LTD.

STANDARD OIL TEST SHEET

CUSTOMER: TORONTO METRO ZOO **REF NO.:** 9951

LOCATION: WEST HILL, ONTARIO

****

The following standards are applicable for transformer oil tests.

It is recommended a sample be tested every 12 months.

DIELECTRIC: (Kilo Volt breakdown A. S. T. M. Standard) For safe and satisfactory operation, this should not be below 25 Kilo Volts.

ACID: Neutralization Number mg. KOH/g. New oil has a Neutralization Number of approximately .03. As this value increases, oxidation and final sludging is progressively indicated.

INTERFACIAL TENSION: (I.F.T. Dynes/CM) New oil has an I.F.T. of 35 - 40 Dynes. This drops very rapidly in early stages of contamination, but serious contamination is not indicated until a value of approximately 14 - 17 dynes is reached.

COLOUR: New oil has a colour value of approximately No. 1. A change in colour indicates contamination and has value in final evaluation of oil condition.

TEST RESULTS WERE AS FOLLOWS;

SERIAL NO.	NEUT NO.	COLOUR	IFT	DIELECTRIC
Vault N/A LG37991	.01	1	42.3	38
Vault N/A 861965	.01	1	44.0	44
Vault N/A 861965	.01	1	43.2	30
Vault N/A				
#1-861941	.02	1	44.0	48
#2-861940	.02	1.25	44.4	45
#3-861943	.01	1	44.0	44
No #	.01	1	43.2	42

METRO ZOO

Ref. # 9951 — 1995 — SHEET No. 1

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

MAIN OUTDOOR SUBSTATION

MAIN INCOMING
Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600

Cat. # 341C.E. K.V. 27.6

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☐ SATISFACTORY
- ☑ SEE GENERAL SHEET. NOTE #1
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. C.O.B Type DYNAGAP

Cat. # 46615-3061 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. NA

Mountings: Cat. # — K.V. — Amp — Type —

Holders: Cat. # — K.V. — Amp — Type —

Refills: Cat. # — K.V. — Amp — Type —

Resistance Test: 1. — 2. — 3. — microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

SHEET No. 2

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

FEEDER TO EURASIA PAVILION

Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600

Cat. # 345634-T2 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE # 2.
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. C.O.B Type DYNAGAP

Cat. # 46615-2061 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S & C ELECTRIC

Mountings: Cat. # — K.V. — Amp — Type —

Holders: Cat. # 8644R-1 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # 134250R4 K.V. 34.5 Amp 150 ~~Type~~ Tcc 153.4

Resistance Test: 1. 725 2. 790 3. 755 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 3

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

FREDDIE'S SERVICE BUILDING

Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600

Cat. # 3456R4-72 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. G.E. Type DYNAGAP

Cat. # 866448R-1 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S & C ELECTRIC

Mountings: Cat. # - K.V. - Amp - Type -

Holders: Cat. # 866448R4 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # 134250R-4 K.V. 34.5 Amp 150 ~~Type~~ TCC 153.4

Resistance Test: 1. 710 2. 760 3. 760 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 4

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

SOCIETY BUILDING

Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600

Cat. # 2345-338C41-1 K.V. 29

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. G.E. Type I.V

Cat. # 217117 K.V. 19 M.C.O.V

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S & C ELECTRIC

Mountings: Cat. # - K.V. - Amp - Type -

Holders: Cat. # 8664R-2 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # _____ K.V. 34.5 Amp 15 Type TCC 15R-4

Resistance Test: 1. 2270 2. 2200 3. 2275 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

TRANSFORMER INSPECTION & TEST SHEET No. 1

SOCIETY BUILDING

Manufacturer CARTE Serial No. N07090-1

Type ONAN H.V. 27.6/16.0 L.V. 208Y/120 Taps 4-2½%

Gal. Liquid 872 K.V.A. 300

% Impedance 4.58 VECTOR WYE/WYE

Liquid Sample

Serial No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity
		N.T			

The above results are satisfactory.

Insulation Resistance Test

		Test Voltage D.C.
H.V. to Ground	5/5 megohms	1000
L.V. to Ground	200 megohms	
H.V. to L.V.	200 megohms	

The above results are satisfactory.

Station Grounding System: 2.50 Ohm

T. WOOD CO. LTD. 06/03

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. NO 7090-1

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS 48 °C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position C for 100 % - volts

Ref. # 9951 SHEET No. 5

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

INDO-MALAYA PAVILION

Interrupter Switch Specifications: Manuf. S&C ELECTRIC Amps 600

CELL #1 - FEEDER TO ENTRANCE TRANSFORMERS Cat. # 3403 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GP

Cat. # 46157 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 500+ 3. 500+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. NA

Mountings: Cat. # - K.V. - Amp - Type -

Holders: Cat. # - K.V. - Amp - Type -

Refills: Cat. # - K.V. - Amp - Type -

Resistance Test: 1. - 2. - 3. - microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 6

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

FEEDER TO AFRICA PAVILION.

Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600

Cat. # 34062 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type G.P.

Cat. # 46159 K.V. 2.4

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. NA

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 7

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

FEEDER TO T2

Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600

Cat. # 345623R4-T2 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. G.E. Type G.P.

Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S & C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 8664R1 K.V. 345 Amp 300E Type SM-5

Refills: Cat. # 134044R4 K.V. 345 Amp 25 ~~Type~~ TCC 153-4

Resistance Test: 1. 1980 2. 1980 3. 1980 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600
PADLOCK FEATURE
Cat. # 345624-T Series K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GA
Cat. # 4616 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. 1900 M 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. S & C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 866461 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # 134125CY K.V. 34.5 Amp 80 ~~Type~~ TCC 153-4

Resistance Test: 1. _____ 2. 1170 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

TRANSFORMER INSPECTION & TEST SHEET No. 1

INDO- MALAYA PAVILION TRANSFORMER T2

Manufacturer WESTINGHOUSE Serial No. 795156

No. LWAN H.V. 27600Y/16000 L.V. 208 Y 1120 Taps 4 - 2½% ↑2

Gal. Liquid 200 K.V.A. 500/560

% Impedance 7.1 VECTOR WYE / WYE CSA

Liquid Sample

Serial No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity

The above results are satisfactory.

Insulation Resistance Test

		Test Voltage D.C.
H.V. to Ground	5/9 megohms	1000
L.V. to Ground	50 megohms	"
H.V. to L.V.	50 megohms	"

The above results are satisfactory.

Station Grounding System: 1.50 Ohm

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. 795156

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS 40 °C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position 3 for 27,600 volts

Ref. # 9951 Sheet # 11

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE _____ & ENCLOSURES

Designation: INDO-MALAYA TAV. - MAIN.

SPECIFICATION:

Manufacturer : F.P.E
Interrupt. Cap : 50KA
Frame Size : 1600 AMP
Elect. Operated: NA
Manul. Operated: ✓

Serial # : TH-4143-72
Volts : 600
Type : 50HZ
Poles : 3
Fixed: _____ / Draw Out: ✓

TRIPPING DEVICE:

Type: P.A.
Longtime P/U : 1600 amps
Shorttime P/U: 6400 amps
Grd Fault P/U: NA amps
Instant. P/U : NA amps
Fused Rating & Manufacturer: NA

Coil/C.T. Rating 1600 amps
Delay MIN T/B ~~seconds~~
Delay 15 CYCLE ~~seconds~~
Delay NA seconds

CONTACT RESISTANCE:

Phase I 32 Phase II 30 Phase III 32 microhms

INSULATION RESISTANCE:

Phase I 200+ Phase II 200+ Phase III 200+ megohms

GENERAL:		O.K.	NOTE#			O.K.	NOTE#
1.	Exterior Enclosure Condition	✓		12.	Lubricated	✓	
2.	Arcing Contacts	✓		13.	Breaker Cleaned	✓	
3.	Main Contacts	✓		14.	Enclosure Cleaned	✓	
4.	Exterior Breaker Condition	✓		15.	Bus Connections	✓	
5.	Tripping Device Condition		✓	16.	Cable Connections	✓	
6.	Manual Closing Operation	✓		17.	Voltmeter	✓	
7.	Manual Tripping Operation	✓		18.	Ammeter	✓	
8.	Electrical Closing Operation			19.	Arc Chute Condition	✓	
9.	Electrical Tripping Operation			20.	Barrier Condition	✓	
10.	Secondary Auxillary Contacts	✓		21.	Single Phase Indicators		
11.	Breaker Drawout Clusters	✓		22.	Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

_____ Moulded Case Breakers

20 Fused Switches

f. # 9951 Sheet # 12

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE _____ & ENCLOSURES

Designation: INDO-MALAYA TAV - DP-MB

PECIFICATION:

Manufacturer : T.P.E
Serial # : TH-4124/72
Interrupt. Cap : 50KA
Volts : 600
Frame Size : 1600AMP
Type : 50H-2
Elect. Operated: —
Poles : 3
Manul. Operated: ✓
Fixed: ✓ / Draw Out: _____

RIPPING DEVICE:

Type: TA
Coil/C.T. Rating 1000 amps
Longtime P/U : 1000 amps
Delay MIN T/B ~~seconds~~
Shorttime P/U: NA amps
Delay NA seconds
Grd Fault P/U: NA amps
Delay NA seconds
Instant. P/U : 4000 amps
Fused Rating & Manufacturer: NA

ONTACT RESISTANCE:

Phase I 41 Phase II 42 Phase III 45 microhms

NSULATION RESISTANCE:

Phase I 200↑ Phase II 200↑ Phase III 200↑ megohms

GENERAL:	O.K.	NOTE#		O.K.	NOTE#
1. Exterior Enclosure Condition	✓		12. Lubricated	✓	
2. Arcing Contacts	✓		13. Breaker Cleaned	✓	
3. Main Contacts	✓		14. Enclosure Cleaned	✓	
4. Exterior Breaker Condition	✓		15. Bus Connections	✓	
5. Tripping Device Condition		✓	16. Cable Connections	✓	
6. Manual Closing Operation	✓		17. Voltmeter		
7. Manual Tripping Operation	✓		18. Ammeter		
8. Electrical Closing Operation			19. Arc Chute Condition	✓	
9. Electrical Tripping Operation			20. Barrier Condition	✓	
10. Secondary Auxillary Contacts			21. Single Phase Indicators		
11. Breaker Drawout Clusters			22. Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

_____ Moulded Case Breakers

_____ Fused Switches

TH/11-92R

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

SERVICE BUILDING,
Interrupter Switch Specifications: Manuf. S & C ELECTRIC Amps 600
FEEDER TO MAIN OUTDOOR SWITCHGEAR Cat. # 34063 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type G.E.
Cat. # 466159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. N.A.

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

SERVICE ENTR. LDG
Interrupter Switch Specifications: Manuf. SIC ELECTRIC Amps 600
PADDOCK TERRACE WEST
Cat. # 34563R4-75 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type G.P.
Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. 200[1] 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. SIC ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 8664K1 K.V. 345 Amp 300 Type SMS

Refills: Cat. # 12412SR4 K.V. 5½ Amp 25 Type NEW

Resistance Test: 1. _____ 2. 1160 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9101

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

SERVICE BUILDING
Interrupter Switch Specifications: Manuf. [illegible] Amps 600
PARKER FEED EAST
Cat. # 3430-R4-T Kv. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. [illegible] Type [illegible]
Cat. # [illegible] K.V. [illegible]

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. 200+ 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. [illegible]

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 2664HRI K.V. [illegible] Amp [illegible] Type [illegible]

Refills: Cat. # 2412SCF K.V. [illegible] Amp [illegible] Type [illegible]

Resistance Test: 1. _____ 2. 963 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Service Building
Interrupter Switch Specifications: Manuf. S&C ELECTRIC Amps 600
For [illegible]
Cat. # 24062 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. [illegible] Type GE
Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. [illegible] 3. [illegible] megohms
The above values are satisfactory.

Fuse Specifications Manuf. S&C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # [illegible] K.V. [illegible] Amp [illegible] Type [illegible]

Refills: Cat. # [illegible] K.V. [illegible] Amp [illegible] Type [illegible]

Resistance Test: 1. 1170 2. [illegible] 3. [illegible] microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Interrupter Switch Specifications: Manuf. [illegible] Amps [illegible]

Cat. # [illegible] K.V. [illegible]

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GP

Cat. # 46154 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms

The above values are satisfactory.

Fuse Specifications Manuf. NA

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9401

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

EUROPEAN TRANSFORMER
Interrupter Switch Specifications: Manuf. S+C ELECTRIC Amps 600
INTERRUPTER SWITCH
4 SOUTH Cat. # 3456B-TG K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary. SEE GENERAL

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GE
Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. S+C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 8664011 K.V. 34.5 Amp 200 Type SMU-5

Refills: Cat. # 134125 K.V. 34.5 Amp 25 Type 13S-V

Resistance Test: 1. _____ 2. 1200 3. 1200 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 19

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

EURASIA PAVILION
Interrupter Switch Specifications: Manuf. S&C ELECTRIC Amps 600
FEEDER TO OUTDOOR SUB
Cat. # 340L=C 3 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GP.
Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. NA

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 995.1

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Interrupter Switch Specifications: Manuf. S&C ELECTRIC Amps 600

Cat. # 345-211-12 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. N A Type _____

Cat. # _____ K.V. _____

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. _____ 3. _____ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S&C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 816401R1 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # 12425R1 K.V. 34.5 Amp 15 Type 15E-1

Resistance Test: 1. 2200 2. 2200 3. 2170 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

TRANSFORMER INSPECTION & TEST SHEET No. 1

MUSEIA PAVILLION TRANSFORMER T-1

Manufacturer WESTINGHOUSE Serial No. 249320

To LVAN H.V. 27600/11000 L.V. 208Y/120 Taps 4-2½% ±2

Gal. Liquid 200 K.V.A. 500/560

Impedance 5.9 VECTOR Wye/Wye ccn

Liquid Sample

Gal No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity

The above results are satisfactory.

Insulation Resistance Test — Test Voltage D.C.

H.V. to Ground >1G megohms 1000

L.V. to Ground 60 megohms "

H.V. to L.V. 60 megohms

The above results are satisfactory.

Station Grounding System: 2.50 Ohm

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. 849380

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS 28 ° C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position 3 for 27600 volts

:f. # 9951 Sheet # 23

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE _____ & ENCLOSURES

Designation: EURASIA "I" VILLA

CIFICATION:

Manufacturer : ITE
Serial # : 98013
Interrupt. Cap : 50KA
Volts : 600 (208/120)
Frame Size : 1600 AMP
Type : K-1600
Elect. Operated: —
Poles : 3
Manul. Operated: ✓
Fixed: _____ / Draw Out: ✓

TRIPPING DEVICE:

Type: [illegible]
Coil/C.T. Rating 800 amps
Longtime P/U : 800 amps
Delay MIN T/A seconds
Shorttime P/U: 3200 amps
Delay MIN T/B seconds
Grd Fault P/U: NA amps
Delay — seconds
Instant. P/U : NA amps
Fused Rating & Manufacturer: NA

NTACT RESISTANCE:

Phase I [illegible] Phase II [illegible] Phase III [illegible] microhms

ULATION RESISTANCE:

Phase I [illegible] Phase II [illegible] Phase III [illegible] megohms

GENERAL:		O.K.	NOTE#			O.K.	NOTE#
1.	Exterior Enclosure Condition	✓		12.	Lubricated	✓	
2.	Arcing Contacts	✓		13.	Breaker Cleaned	✓	
3.	Main Contacts	✓		14.	Enclosure Cleaned	✓	
4.	Exterior Breaker Condition	✓		15.	Bus Connections	✓	
5.	Tripping Device Condition	✓		16.	Cable Connections	✓	
6.	Manual Closing Operation	✓		17.	Voltmeter	✓	
7.	Manual Tripping Operation	✓		18.	Ammeter	✓	
8.	Electrical Closing Operation			19.	Arc Chute Condition	✓	
9.	Electrical Tripping Operation			20.	Barrier Condition	✓	
10.	Secondary Auxillary Contacts	✓		21.	Single Phase Indicators		
11.	Breaker Drawout Clusters	✓		22.	Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

_____ Moulded Case Breakers

2 Fused Switches

TH/11-92R

Ref. # 9951

SHEET No. 24

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

AFRICA PAVILION

Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600

TRANSFORMER T-6

Cat. # 345,244 -T2 K.V. 23

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. N/A Type —

Cat. # — K.V. —

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. _____ 3. _____ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S/C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 266V6K1 K.V. 34.5 Amp 200 Type SMU-5

Refills: Cat. # 1E40662Y K.V. 34.5 Amp 40 Type TCC 15E-40

Resistance Test: 1. 1010 2. 1025 3. 1020 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 25

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Interrupter Switch Specifications: Manuf. S&C ELECTRIC Amps 600
Cat. # 340[illegible] K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type DYNA-GAP
Cat. # [illegible] K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. >200 2. >200 3. >200 megohms
The above values are satisfactory.

Fuse Specifications Manuf. N/A

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

SHEET No. 26

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Interrupter Switch Specifications: Manuf. S/E ELECTRIC Amps 600
ARRIVAL TRANSFORMER
FEEDER TO INDO-MALAYA TAV
Cat. # [illegible] K.V. 22

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. [illegible] Type DUAL-GAP.
Cat. # [illegible] K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. N/A

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 29

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

AFRICA PAVILION
PANDORA - THE WORLD

Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600

Cat. # 345604-12 K.V. 29

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☐ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. _____ Type _____

Cat. # _____ K.V. _____

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. _____ 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. S/C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 86640E1 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # 13412-R1 K.V. 34.5 Amp 40 Type TCC 153-V

Resistance Test: 1. _____ 2. 1200 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

G. T. WOOD CO. LTD. 9/27/83

SHT-28

TRANSFORMER INSPECTION & TEST SHEET No. 1

TRICITY PAVILION TRANSFORMER T-6

Manufacturer WESTINGHOUSE Serial No. 79-1511

No. 1-PHASE H.V. 27,600Y/16,000 L.V. 208Y/120 Taps 4-2½% F.C.

Wt. Liquid 350 K.V.A. 750/1000

Impedance 6.0 VECTOR WYE/WYE 60 CY

Liquid Sample

Serial No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity

The above results are satisfactory.

Insulation Resistance Test

		Test Voltage D.C.
H.V. to Ground	S/G megohms	1000
L.V. to Ground	100 megohms	"
H.V. to L.V.	100 megohms	"

The above results are satisfactory.

Station Grounding System: 2.50 Ohm

G. T. WOOD CO. LTD. 06/03

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. 795154

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS 65 °C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position 3 for 27600 volts

Ref. # 9951 Sheet # 30

LOW VOLTAGE BREAKER / / DISCONNECT DEVICE _____ & ENCLOSURES

Designation: AFRICAN PAVILION - MAIN

SPECIFICATION:

Manufacturer : F.P.E
Interrupt. Cap : 75 KA
Frame Size : 2000 AMP
Elect. Operated: ✓
Manul. Operated: ✓

Serial # : TH 4136-92
Volts : 600 (120/208)
Type : 7-H-3
Poles : 3
Fixed: _____ / Draw Out: —

TRIPPING DEVICE:

Type: PA
Longtime P/U : 2000 amps
Shorttime P/U: 8000 amps
Grd Fault P/U: — amps
Instant. P/U : — amps
Fused Rating & Manufacturer: —

Coil/C.T. Rating 2000 amps
Delay MAX/A seconds
Delay 15 CYCLE seconds
Delay — seconds

CONTACT RESISTANCE:

Phase I 29 Phase II 30 Phase III 27 microhms

INSULATION RESISTANCE:

Phase I 200 Phase II 200 Phase III 200 megohms

GENERAL:	O.K.	NOTE#		O.K.	NOTE#
1. Exterior Enclosure Condition	✓		12. Lubricated	✓	
2. Arcing Contacts	✓		13. Breaker Cleaned	✓	
3. Main Contacts	✓		14. Enclosure Cleaned	✓	
4. Exterior Breaker Condition	✓		15. Bus Connections	✓	
5. Tripping Device Condition		✓	16. Cable Connections	✓	
6. Manual Closing Operation	✓		17. Voltmeter	✓	
7. Manual Tripping Operation	✓		18. Ammeter	✓	
8. Electrical Closing Operation	✓		19. Arc Chute Condition	✓	
9. Electrical Tripping Operation	✓		20. Barrier Condition	✓	
10. Secondary Auxillary Contacts	✓		21. Single Phase Indicators		
11. Breaker Drawout Clusters	✓		22. Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

_____ Moulded Case Breakers

_____ Fused Switches

TH/11-92R

9951 Sheet # 31

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE ____ & ENCLOSURES

Designation: AFRICIA PAVILION - MCC-A1

FICATION:

Manufacturer : FPE
Interrupt. Cap : 50kA
Frame Size : 1600 AMP
Elect. Operated: —
Manul. Operated: ✓

Serial # : TH 4125-92.
Volts : 600
Type : FOH-3
Poles : 3
Fixed: ✓ / Draw Out: ____

RIPPING DEVICE:

Type: PA
Longtime P/U : 1000 amps
Shorttime P/U: — amps
Grd Fault P/U: — amps
Instant. P/U : 4000 amps
Fused Rating & Manufacturer: NA

Coil/C.T. Rating 1000 amps
Delay MIN T/A seconds
Delay — seconds.
Delay — seconds

X ITACT RESISTANCE:

Phase I 35 Phase II 42 Phase III 45 microhms

I ATION RESISTANCE:

Phase I 200 Phase II 200 Phase III 200 megohms

GENERAL:	O.K.	NOTE#		O.K.	NOTE#
Exterior Enclosure Condition	✓		12. Lubricated	✓	
Arcing Contacts	✓		13. Breaker Cleaned	✓	
Main Contacts	✓		14. Enclosure Cleaned	✓	
Exterior Breaker Condition	✓		15. Bus Connections	✓	
5. Tripping Device Condition		✓	16. Cable Connections	✓	
Manual Closing Operation	✓		17. Voltmeter		
7. Manual Tripping Operation	✓		18. Ammeter		
Electrical Closing Operation			19. Arc Chute Condition	✓	
9. Electrical Tripping Operation			20. Barrier Condition	✓	
1. Secondary Auxillary Contacts			21. Single Phase Indicators		
1. Breaker Drawout Clusters			22. Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

____ Moulded Case Breakers

21 Fused Switches

TH/11-92R

Ref. # 995.1

SHEET No. 32

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

NORTH AMERICA PAVILION
Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600
FEEDER TO ARENA 1 & 2 Cat. # 3H6L-47 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type S.P
Cat. # 4659 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. _____

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

Interrupter Switch Specifications: Manuf. NORTH AMERICA INV. TRANSFORMER T-S Amps 600

Cat. # 34563R4-72 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. NA Type _____

Cat. # _____ K.V. _____

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. _____ 3. _____ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S/C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 86644R1 K.V. 34.5 Amp 300 Type SM 5

Refills: Cat. # 130025R4 K.V. 34.5 Amp 15 Type TCC 153.4

Resistance Test: 1. 2280 2. 2287 3. 2300 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 1951

SHEET No. 34

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

NORTH AMERICA PAVILION
Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600
FEEDS TO SERVICE BLDG.
Cat. # 2101-C Kv. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GP
Cat. # 4L-1-9 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. _____

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 1-11 SHEET No. 35

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

NORTH AMERICAN PHILLIPS
Interrupter Switch Specifications: Manuf. S&C ELECTRIC Amps 600
PADDOCK TEXTILE
Cat. # 345634R4-T2 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO Type GP
Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. 200 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. _____

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 866442 K.V. 34.5 Amp 300 Type JN5

Refills: Cat. # 2601252 K.V. 34.5 Amp 80 Type TCC 119-4

Resistance Test: 1. _____ 2. 1160 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

SNT-36

TRANSFORMER INSPECTION & TEST SHEET No. 1

Nova Inverness

ufacturer Westinghouse Serial No.

o LNAN H.V. 24600Y/16000 L.V. 208Y/120 Taps 4-2½%

. Liquid 200 K.V.A. 500/560

Impedance 7.1 VECTOR Dyn / Yyn

uid Sample

ial No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity

The above results are satisfactory.

sulation Resistance Test

Test Voltage D.C.

H.V. to Ground	5/9	megohms	1000
L.V. to Ground	100	megohms	"
H.V. to L.V.	100	megohms	"

The above results are satisfactory.

Station Grounding System: 2.50 Ohm

G.T. WOOD CO. LTD. 06/03

SAT-37

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. .....

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS [52] °C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position 3 for 22600 volts

ef. # 7951 Sheet # 38

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE ____ & ENCLOSURES

Designation: NORTH AMERICAN PAN - MAIN

PECIFICATION:

Manufacturer : ITE
Serial # : 72017
Interrupt. Cap : 50KA
Volts : 600 - 120/208?
Frame Size : 1600 AMP
Type : K-1600
Elect. Operated: —
Poles : 3
Manul. Operated: ✓
Fixed: ____ / Draw Out: ✓

RIPPING DEVICE:

Type: 0214
Coil/C.T. Rating 1200 amps
Longtime P/U : 1100 amps
Delay MIN T/S seconds
Shorttime P/U: 4000 amps
Delay MIN T/S seconds
Grd Fault P/U: — amps
Delay — seconds
Instant. P/U : ____ amps
Fused Rating & Manufacturer: —

ONTACT RESISTANCE:

Phase I 32 Phase II 35 Phase III 29 microhms

NSULATION RESISTANCE:

Phase I 700 Phase II 700 Phase III 200 megohms

GENERAL:		O.K.	NOTE#			O.K.	NOTE#
1.	Exterior Enclosure Condition	✓		12.	Lubricated	✓	
2.	Arcing Contacts	✓		13.	Breaker Cleaned	✓	
3.	Main Contacts	✓		14.	Enclosure Cleaned	✓	
4.	Exterior Breaker Condition	✓		15.	Bus Connections	✓	
5.	Tripping Device Condition	✓		16.	Cable Connections	✓	
6.	Manual Closing Operation	✓		17.	Voltmeter	✓	
7.	Manual Tripping Operation	✓		18.	Ammeter	✓	
8.	Electrical Closing Operation			19.	Arc Chute Condition	✓	
9.	Electrical Tripping Operation			20.	Barrier Condition	✓	
0.	Secondary Auxillary Contacts	✓		21.	Single Phase Indicators		
1.	Breaker Drawout Clusters	✓		22.	Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

____ Moulded Case Breakers

____ Fused Switches

TH/11-92R

Ref. # 9951 SHEET No. 39

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

ENT. FACILITIES
Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600
TESTED TO JOHN MALYN PAV.
Cat. # 3416? K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO BRASS Type GAP
Cat. # 46159 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 200+ 2. 200+ 3. 200+ megohms
The above values are satisfactory.

Fuse Specifications Manuf. _____

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

SHEET No. 40

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

ENT. FACILITIES
Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600
FEEDER TO VILLAGE LIGHT SOUTH Cat. # 345624-7? K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. OHIO [illegible] Type [illegible]
Cat. # [illegible] K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. 200+ 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. S/C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 86644R1 K.V. [illegible] Amp [illegible] Type [illegible]

Refills: Cat. # 134175-K4 K.V. [illegible] Amp 20 Type [illegible]

Resistance Test: 1. _____ 2. [illegible] 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

ENT. FACILITIES
TRANSFORMER T.S

Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600

Cat. # 2456244-72 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. ASEA Type _____

Cat. # _____ K.V. _____

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. _____ 3. _____ megohms

The above values are satisfactory.

Fuse Specifications Manuf. S/C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 866481 K.V. 24.5 Amp 300 Type SM 5

Refills: Cat. # 13404CX4 K.V. 24.5 Amp 25 Type TCC 153-4

Resistance Test: 1. 1900 2. 1910 3. 1900 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9151 SHEET No. 42

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

ENT FACILITIES
Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600
FEEDER TO LUCASIA PAV
Cat. # 3615R1 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☑ SATISFACTORY
- ☐ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. CANADIAN Type GE
Cat. # 4L61B9 K.V. 24

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. 300 2. 300 3. 300 megohms
The above values are satisfactory.

Fuse Specifications Manuf. _____

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # _____ K.V. _____ Amp _____ Type _____

Refills: Cat. # _____ K.V. _____ Amp _____ Type _____

Resistance Test: 1. _____ 2. _____ 3. _____ microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

Ref. # 9951 SHEET No. 43

INSPECTION & TEST REPORT FOR SERVICE ENTRANCE POLE & METALCLAD SWITCHGEAR

ENT FACILITIES.
Interrupter Switch Specifications: Manuf. S/C ELECTRIC Amps 600
TRANSFORMER T-7
Cat. # 3605X4-73 K.V. 27

Insulation: Intact and thoroughly cleaned.

Alignement & Mechanism: Operated normally. Lubricated where necessary.

Contacts: Cleaned, conditioned and sealed against oxidation.

Interrupting Units:
- ☐ SATISFACTORY
- ☒ SEE GENERAL SHEET. NOTE #
- ☐ NOT APPLICABLE

Lightning Arrester Specification Manuf. _____ Type _____
Cat. # _____ K.V. _____

Insulation: Intact and thoroughly cleaned.

Cementing: Free from deterioration.

Insulation Resistance Test: 1. _____ 2. _____ 3. _____ megohms
The above values are satisfactory.

Fuse Specifications Manuf. S/C ELECTRIC

Mountings: Cat. # _____ K.V. _____ Amp _____ Type _____

Holders: Cat. # 866441 K.V. 34.5 Amp 300 Type SM-5

Refills: Cat. # 13425R4 K.V. 34.5 Amp 15 Type ~~Type~~ TCC 153.4

Resistance Test: 1. 2180 2. 219.5 3. 2220 microhms

The above values are satisfactory.
All associated insulation was intact and thoroughly cleaned.
Contact surfaces were cleaned, conditioned and sealed against oxidation.
A spare set of refills should be stored in a convenient location at all times.

SH47 · 4

TRANSFORMER INSPECTION & TEST SHEET No. 1

ENT. FACILITIES T7

nufacturer WESTINGHOUSE Serial No. 827694

o LINN H.V. 27600 | 16000 L.V. 208Y / 120 Taps 4 · 2 ½ %

l. Liquid 150 K.V.A. 225 / 252

Impedance 6.9 VECTOR Wye / Wye

uid Sample

ial No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity

The above results are satisfactory.

sulation Resistance Test — Test Voltage D.C.

H.V. to Ground S/G megohms 1000

L.V. to Ground 55 megohms "

H.V. to L.V. 55 megohms "

The above results are satisfactory.

Station Grounding System: < 50 Ohm

SM-45

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. 827694

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS 32 °C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position ? for 27600 volts

SHT 46

TRANSFORMER INSPECTION & TEST SHEET No. 1

ENT. FACILITIES T.S.

nufacturer WESTINGHOUSE Serial No. 850412

o LOAN H.V. 27600Y/16000 L.V. 600Y/347 Taps 4-2½

l. Liquid 310 K.V.A. 500/560

Impedance 6.7 VECTOR WYE/WYE

Liquid Sample

ial No.	Neut. No.	Colour	I.F.T.	Dielectric	Spec. Gravity

The above results are satisfactory.

Insulation Resistance Test

			Test Voltage D.C.
H.V. to Ground	5/9	megohms	1000
L.V. to Ground	65	megohms	"
H.V. to L.V.	65	megohms	"

The above results are satisfactory.

Station Grounding System: < 1.50 Ohm

TRANSFORMER INSPECTION & TEST SHEET No. 2

GENERAL CONDITIONS

Serial No. 850912

Bushings: Insulation was intact and thoroughly cleaned. Cementing was free from deterioration.

Gaskets:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Paint:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Liquid Level:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

Thermometer:
- [x] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE

MAXIMUM TEMPERATURE WAS 45 ° C

Cooling System:
- [x] CLEAR
- [ ] SEE GENERAL SHEET. NOTE

Gas Detector Relay:
- [ ] SATISFACTORY
- [ ] SEE GENERAL SHEET. NOTE
- [x] NOT APPLICABLE

Terminal Board and/or Tap Switch: located in position 3 for 27600 volts

Ref. # 9951 Sheet # 48

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE _____ & ENCLOSURES

Designation: ENT. FACILITIES - MAIN T-7

SPECIFICATION:

Manufacturer : WESTINGHOUSE
Serial # : CP21379-02-A1
Interrupt. Cap : 50KA
Volts : 600
Frame Size : 1600 AMP
Type : DB-50
Elect. Operated: —
Poles : 3
Manul. Operated: ✓
Fixed: _____ / Draw Out: ✓

TRIPPING DEVICE:

Type: DB
Coil/C.T. Rating 1000 amps
Longtime P/U : 640 amps
Delay 20 seconds
Shorttime P/U: 4000 amps
Delay 30 CYCLE seconds
Grd Fault P/U: — amps
Delay — seconds
Instant. P/U : — amps
Fused Rating & Manufacturer: —

CONTACT RESISTANCE:

Phase I 39 Phase II 42 Phase III 40 microhms

INSULATION RESISTANCE:

Phase I 200 Phase II 200 Phase III 200 megohms

GENERAL:		O.K.	NOTE#			O.K.	NOTE#
1.	Exterior Enclosure Condition	✓		12.	Lubricated	✓	
2.	Arcing Contacts	✓		13.	Breaker Cleaned	✓	
3.	Main Contacts	✓		14.	Enclosure Cleaned	✓	
4.	Exterior Breaker Condition	✓		15.	Bus Connections	✓	
5.	Tripping Device Condition	✓		16.	Cable Connections	✓	
6.	Manual Closing Operation	✓		17.	Voltmeter	✓	
7.	Manual Tripping Operation	✓		18.	Ammeter	✓	
8.	Electrical Closing Operation			19.	Arc Chute Condition	✓	
9.	Electrical Tripping Operation			20.	Barrier Condition	✓	
0.	Secondary Auxillary Contacts	✓		21.	Single Phase Indicators		
.1.	Breaker Drawout Clusters			22.	Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

_____ Moulded Case Breakers

6 Fused Switches

TH/11-92R

Sheet # 49

: # 9951

LOW VOLTAGE BREAKER ✓ / DISCONNECT DEVICE ____ & ENCLOSURES

Designation: ENT. FACILITIES T.S

IFICATION:

Manufacturer : WESTINGHOUSE
Interrupt. Cap : 25KA
Frame Size : 600 A
Elect. Operated: —
Manul. Operated: ✓

Serial # : CP21379-01-A1
Volts : 600
Type : DP-25
Poles : 3
Fixed: ____ / Draw Out: —

TRIPPING DEVICE:

Type: DP-1

Longtime P/U : 600 amps
Shorttime P/U: 3000 amps
Grd Fault P/U: — amps
Instant. P/U : — amps

Coil/C.T. Rating 600 amps
Delay 20 seconds
Delay 6cycle seconds.
Delay — seconds

Fused Rating & Manufacturer: —

O TACT RESISTANCE:

Phase I 45 Phase II 51 Phase III 45 microhms

I LATION RESISTANCE:

Phase I 200 Phase II 200 Phase III 200 megohms

G JERAL:

		O.K.	NOTE #
1.	Exterior Enclosure Condition	✓	
	Arcing Contacts	✓	
3.	Main Contacts	✓	
	Exterior Breaker Condition	✓	
5.	Tripping Device Condition	✓	
	Manual Closing Operation	✓	
	Manual Tripping Operation	✓	
	Electrical Closing Operation		
	Electrical Tripping Operation		
10.	Secondary Auxillary Contacts	✓	
	Breaker Drawout Clusters	✓	

		O.K.	NOTE #
12.	Lubricated	✓	
13.	Breaker Cleaned	✓	
14.	Enclosure Cleaned	✓	
15.	Bus Connections	✓	
16.	Cable Connections	✓	
17.	Voltmeter	✓	
18.	Ammeter	✓	
19.	Arc Chute Condition	✓	
20.	Barrier Condition	✓	
21.	Single Phase Indicators		
22.	Others		

The secondary equipment was serviced and left in satisfactory condition and consisted of

____ Moulded Case Breakers
____ Fused Switches

TH/11-92R

G.T. WOOD CO. LTD.
3354 Mavis Rd. Mississauga, Ont. L5C 1T8
TEL: (905) 272-1696 Fax: (905) 272-1425

February 28, 1995

METRO TORONTO ZOO
P.O. Box 280,
West Hill, Ontario,
M1E 4R5

ATTN: Mr. Dean Evans

RE: Your PO #12124
Our Ref #9951

Dear Sir;

In accordance with your request, we have completed the Inspection and Testing of the substation and associated electrical equipment at the above location.

Please find enclosed our test report for your reference.

Thank you for the favour of this business.

Yours very truly,
G.T. WOOD COMPANY LIMITED

L.A. Snow
LAS/jn

Encl.
RSCL/1

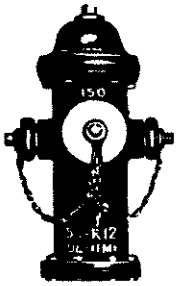
APPENDIX 6

LIST OF GAS-FIRED EQUIPMENT

APPENDIX 7

FIRE HYDRANT TEST RESULTS

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(1)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: West of Indian Ring Rd
HYDRANT MAKE: M67
DATE: Dec 21 RK

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED ☐ — OK ☐ — NOT VISIBLE ☑ — CLOSED ☐ — INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☐ O/L ☐ — OK ☑ — DIFFICULT ☐ — LEAKING ☐ — INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 30 — PITOT 109 — USGPM
9. PRESSURE TEST @ 100 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☑ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — [illegible] ☐

SERVICED BY: Rick

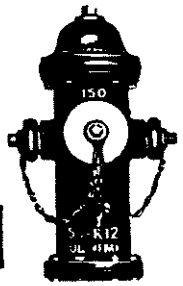
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		
59. OTHER	OK ☐		
60. OTHER	OK ☐		
61. OTHER	OK ☐		
62. OTHER	OK ☐		
63. OTHER	OK ☐		

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(2)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: South of Ind's Pavilion
HYDRANT MAKE: B50B
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — R/S ☑ LEADED ☑ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 36 — PITOT 1116 — USGPM
9. PRESSURE TEST @ 60 PSIG — PASSED ☐ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☐ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☑ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: Max

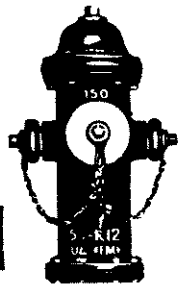
CUSTOMER REPRESENTATIVE:

COMMENTS: Hydrant has minor leak at ground flange.

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			☐
59. OTHER	OK ☐			☐
60. OTHER	OK ☐			☐
61. OTHER	OK ☐			☐
62. OTHER	OK ☐			☐
63. OTHER	OK ☐			☐

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

3

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: South of Athletic Centre Entrance
HYDRANT MAKE: Century
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED ☐ — OK ☐ / NOT VISIBLE ☑ — CLOSED ☐ / INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ / O/L ☐ — OK ☑ / DIFFICULT ☐ — LEAKING ☐ / INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ / DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ / LEAKING ☐ — R/S ☐ / LEADED ☑ — LOOSE ☐ / DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 20 — PITOT 8 32 — USGPM
9. PRESSURE TEST @ 44 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ / NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ / NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☑ / N/A ☐ — NO ☐
13. GROUND FLANGE — SAFETY ☐ / SOLID ☑ — BURIED ☐ / N/A ☐ — LEAKING ☐ / DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ / NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ / DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

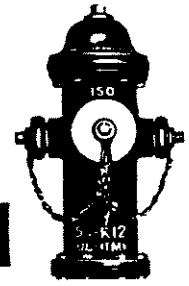
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☐
HYDRANT OPERATION DEFICIENCY ☑



A-1 HYDRANT SERVICES LTD.

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Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(4)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave. Scarborough

HYDRANT LOCATION: Outside gorilla door
HYDRANT MAKE: B50S
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE _____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☐ DIFFICULT ☐ — LEAKING ☑ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER _____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — R/S ☐ LEADED ☑ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 27 — PITOT 9½ — USGPM
9. PRESSURE TEST @ 41 PSIG — PASSED ☐ — FAILED ☑
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR _____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR _____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☐ — BURIED ☑ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION _____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE _____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

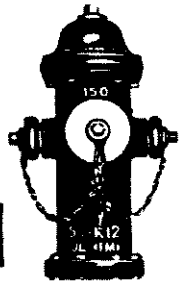
CUSTOMER REPRESENTATIVE:

COMMENTS: Hydrant leaks when fully charged.

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. [illegible]	OK ☐		
59. [illegible]	OK ☐		
60. [illegible]	OK ☐		☐
61. [illegible]	OK ☐		☐
62. [illegible]	OK ☐		☐
63. [illegible]	OK ☐		☐

HYDRANT OPERATION SATISFACTORY [ ]
HYDRANT OPERATION DEFICIENCY [ ]



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

5

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: West side of African Par
HYDRANT MAKE: Century
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 2" slw — LOCATED — OK [✓] — NOT VISIBLE [ ] — CLOGGED [ ] — INOPERABLE [ ]
2. HYDRANT OPERATION — O/R [✓] — O/L [ ] — OK [✓] — DIFFICULT [ ] — LEAKING [ ] — INOPERABLE [ ]
3. CHECK BARREL FOR WATER — WET [ ] — DRY [✓] — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK [✓] — REPLACED [ ]
5. CHECK NOZZLES & THREADS — OK [✓] — LEAKING [ ] — R/S [ ] — LEADED [✓] — LOOSE [ ] — DAMAGED [ ]
6. LUBRICATE HYDRANT — YES [✓] — NOT REQUIRED [ ]
7. LUBE SCREW — OK [✓] — MISSING [ ] — REPLACED [ ]
8. FLOW TEST — 24 — PITOT — 911 — USGPM
9. PRESSURE TEST @ 40 PSIG — PASSED [✓] — FAILED [ ]
10. COLOUR CODED — YES [ ] — NO [✓] — COLOUR ____
11. HYDRANT PAINTED — YES [ ] — NO [✓] — COLOUR ____
12. HYDRANT PUMPED OUT — YES [ ] — N/A [✓] — NO [ ]
13. GROUND FLANGE — SAFETY [ ] — SOLID [✓] — BURIED [ ] — N/A [ ] — LEAKING [ ] — DAMAGED [ ]
14. REQUIRES BARREL EXTENTION ____ — N/A [ ]
15. PUMPER NOZZLE — YES [ ] — NO [✓] — TYPE ____
16. NOZZLE ORIENTATION — OK [✓] — IMPROPER [ ]
17. TRAFFIC BOLLARDS — OK [ ] — DAMAGED [ ] — N/A [✓] — TOO CLOSE [ ]

SERVICED BY: Rex

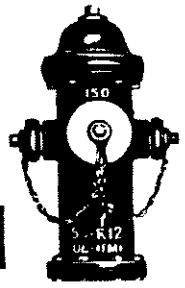
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK [ ]	N/A [ ]	REPLACED [ ]
19. BONNET BOLTS	OK [ ]	N/A [ ]	REPLACED [ ]
20. BONNET	OK [ ]		REPLACED [ ]
21. BONNET SEAL	OK [ ]		REPLACED [ ]
22. OPERATING NUT	OK [ ]		REPLACED [ ]
23. OPERATING NUT O-RING(S)	OK [ ]	N/A [ ]	REPACK [ ]
24. STUFFING BOX	OK [ ]	N/A [ ]	REPLACED [ ]
25. THRUST BEARING	OK [ ]	N/A [ ]	REPLACED [ ]
26. BEARING HOUSING	OK [ ]	N/A [ ]	REPLACED [ ]
27. BEARING HOUSING BOLTS	OK [ ]	N/A [ ]	REPLACED [ ]
28. HOUSING COVER	OK [ ]	N/A [ ]	REPLACED [ ]
29. HOUSING COVER BOLTS	OK [ ]	N/A [ ]	REPLACED [ ]
30. BEARING HOUSING SEAL(S)	OK [ ]	N/A [ ]	REPLACED [ ]
31. UPPER OPERATING ROD	OK [ ]		REPLACED [ ]
32. LOWER OPERATING ROD	OK [ ]		REPLACED [ ]
33. ROD COUPLING	OK [ ]	N/A [ ]	REPLACED [ ]
34. COUPLING BOLTS	OK [ ]	N/A [ ]	REPLACED [ ]
35. LOWER ROD NUT(S)	OK [ ]		REPLACED [ ]
36. LOWER ROD STOP PIN/PLATE	OK [ ]	N/A [ ]	REPLACED [ ]
37. VALVE BALL SEAL(S)	OK [ ]	N/A [ ]	REPLACED [ ]
38. VALVE BALL BOTTOM	OK [ ]		REPLACED [ ]
39. VALVE BALL RUBBER	OK [ ]		REPLACED [ ]
40. VALVE BALL TOP	OK [ ]	N/A [ ]	REPLACED [ ]
41. MAIN VALVE SEAT	OK [ ]		REPLACED [ ]
42. MAIN VALVE SEAT SEAL(S)	OK [ ]		REPLACED [ ]
43. DRAIN VALVE	OK [ ]		REPLACED [ ]
44. DRAIN VALVE SEAL(S)	OK [ ]		REPLACED [ ]
45. DRAIN VALVE PORT(S)	OK [ ]	CLEARED [ ]	REPLACED [ ]
46. DRAIN VALVE COTTER PIN(S)	OK [ ]	N/A [ ]	REPLACED [ ]
47. LOWER BARREL	OK [ ]		REPLACED [ ]
48. LOWER BARREL FLANGE(S)	OK [ ]	N/A [ ]	REPLACED [ ]
49. UPPER BARREL	OK [ ]		REPLACED [ ]
50. UPPER BARREL FLANGE(S)	OK [ ]	N/A [ ]	REPLACED [ ]
51. BARREL EXTENTION(S)	OK [ ]	N/A [ ]	REPLACED [ ]
52. FLANGE GASKET(S)	OK [ ]	N/A [ ]	REPLACED [ ]
53. FLANGE BOLTS	OK [ ]	N/A [ ]	REPLACED [ ]
54. BOOT	OK [ ]	N/A [ ]	REPLACED [ ]
55. NOZZLE(S)	OK [ ]	RECAULKED [ ]	REPLACED [ ]
56. NOZZLE CAP(S)	OK [ ]		REPLACED [ ]
57. NOZZLE RETAINER(S)	OK [ ]	N/A [ ]	REPLACED [ ]
58. OTHER	OK [ ]		
59. OTHER	OK [ ]		
60. OTHER	OK [ ]		
61. OTHER	OK [ ]		
62. OTHER	OK [ ]		
63. OTHER	OK [ ]		

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(6)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: South of African McDonalds
HYDRANT MAKE: Mueller
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE ____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST Flowed — PITOT ____ USGPM
9. PRESSURE TEST @ 35 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☐ — BURIED ☑ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☐
HYDRANT OPERATION DEFICIENCY ☐

A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(7)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: N/W of African McDons
HYDRANT MAKE: AVK
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 2'S/E LOCATED — OK ☑ — NOT VISIBLE ☐ — CLOSED ☐ — INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ — O/L ☐ — OK ☑ — DIFFICULT ☐ — LEAKING ☐ — INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ — DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ — LEAKING ☐ — R/S ☑ — LEADED ☐ — LOOSE ☐ — DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST — 32 — PITOT — 1052 — USGPM
9. PRESSURE TEST @ 41 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ — NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ — NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ — N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☑ — SOLID ☐ — BURIED ☐ — N/A ☐ — LEAKING ☐ — DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☑ — NO ☐ — TYPE ST
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ — DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: Rick

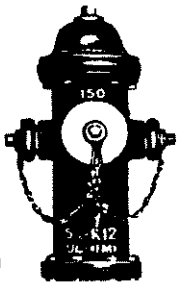
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☐
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

80

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: South end of main Entrance
HYDRANT MAKE: M&H
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	LOCATED ☐	OK ☐	NOT VISIBLE ☑	CLOSED ☐	INOPERABLE ☐
2. HYDRANT OPERATION	O/R ☑ O/L ☐	OK ☑	DIFFICULT ☐	LEAKING ☐	INOPERABLE ☐
3. CHECK BARREL FOR WATER	WET ☐ DRY ☑	AMT. OF WATER			
4. CHECK CAP GASKETS	OK ☑			REPLACED ☐	
5. CHECK NOZZLES & THREADS	OK ☑ LEAKING ☐	R/S ☑	LEADED ☐	LOOSE ☐	DAMAGED ☐
6. LUBRICATE HYDRANT	YES ☑			NOT REQUIRED ☐	
7. LUBE SCREW	OK ☑	MISSING ☐		REPLACED ☐	
8. FLOW TEST 30	PITOT 10 19	USGPM			
9. PRESSURE TEST @ 56 PSIG		PASSED ☑		FAILED ☐	
10. COLOUR CODED	YES ☐ NO ☑	COLOUR			
11. HYDRANT PAINTED	YES ☐ NO ☑	COLOUR			
12. HYDRANT PUMPED OUT	YES ☐ N/A ☑			TD ☐	
13. GROUND FLANGE	SAFETY ☐ SOLID ☐	BURIED ☑ N/A ☐		LEAKING ☐	DAMAGED ☐
14. REQUIRES BARREL EXTENTION				N/A ☐	
15. PUMPER NOZZLE	YES ☐ NO ☑			TYPE	
16. NOZZLE ORIENTATION	OK ☑			IMPROPER ☐	
17. TRAFFIC BOLLARDS	OK ☐ DAMAGED ☐	N/A ☑		TOO CLOSE ☐	

SERVICED BY: [signature]

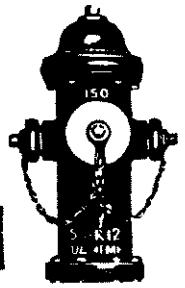
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐	
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐	
20. BONNET	OK ☐		REPLACED ☐	
21. BONNET SEAL	OK ☐		REPLACED ☐	
22. OPERATING NUT	OK ☐		REPLACED ☐	
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐	
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐	
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐	
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐	
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐	
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐	
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐	
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐	
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐	
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐	
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐	
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐	
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐	
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐	
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐	
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐	
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐	
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐	
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐	
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐	
43. DRAIN VALVE	OK ☐		REPLACED ☐	
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐	
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐	
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐	
47. LOWER BARREL	OK ☐		REPLACED ☐	
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐	
49. UPPER BARREL	OK ☐		REPLACED ☐	
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐	
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐	
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐	
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐	
54. BOOT	OK ☐	N/A ☐	REPLACED ☐	
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐	
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐	
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐	
58.	OK ☐			
59.	OK ☐			
60.	OK ☐			
61.	OK ☐			
62.	OK ☐			
63.	OK ☐			

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(9)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: Inside/Outside holding
HYDRANT MAKE: 250A
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED — OK ☐ NOT VISIBLE ☑ CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ OK ☐ DIFFICULT ☐ LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ R/S ☐ LEADED ☑ LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ MISSING ☐ REPLACED ☐
8. FLOW TEST — 5 — PITOT — 416 — USGPM
9. PRESSURE TEST @ 79 PSIG — PASSED ☐ FAILED ☑
10. COLOUR CODED — YES ☐ NO ☑ COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ NO ☐
13. GROUND FLANGE — SAFETY ☐ BOLTED ☑ BURIED ☐ N/A ☐ LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ TYPE ____
16. NOZZLE ORIENTATION — OK ☑ IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ N/A ☑ TOO CLOSE ☐

SERVICED BY: [signature]

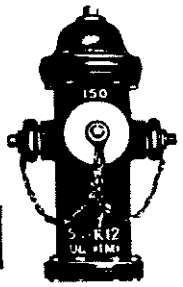
CUSTOMER REPRESENTATIVE: [signature]

COMMENTS: Hydrant leaks when fully charged Secondary valve not visible.

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			☐
59. OTHER	OK ☐			☐
60. OTHER	OK ☐			☐
61. OTHER	OK ☐			☐
62. OTHER	OK ☐			☐
63. OTHER	OK ☐			☐

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(10)

CUSTOMER NAME: Toronto Metro Zoo

SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: West of ~~Africa~~ North American McDon

HYDRANT MAKE: Mueller

DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	LOCATED ☐	OK ☐ / NOT VISIBLE ☑		CLOSED ☐ / INOPERABLE ☐
2. HYDRANT OPERATION	O/R ☑ / O/L ☐	OK ☑ / DIFFICULT ☐		LEAKING ☐ / INOPERABLE ☐
3. CHECK BARREL FOR WATER	WET ☐ / DRY ☑	AMT. OF WATER ____		
4. CHECK CAP GASKETS	OK ☑			REPLACED ☐
5. CHECK NOZZLES & THREADS	O/K ☑ / LEAKING ☐	R/S ☑ / LEADED ☐		LOOSE ☐ / DAMAGED ☐
6. LUBRICATE HYDRANT	YES ☑			NOT REQUIRED ☐
7. LUBE SCREW	OK ☑	MISSING ☐		REPLACED ☐
8. FLOW TEST 46	PITOT 124			USGPM
9. PRESSURE TEST @ 57 PSIG		PASSED ☑		FAILED ☐
10. COLOUR CODED	YES ☐ / NO ☑	COLOUR ____		
11. HYDRANT PAINTED	YES ☐ / NO ☑	COLOUR ____		
12. HYDRANT PUMPED OUT	YES ☐ / N/A ☑			NO ☐
13. GROUND FLANGE	SAFETY ☐ / SOLID ☐	BURIED ☑ / N/A ☐		LEAKING ☐ / DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____				N/A ☐
15. PUMPER NOZZLE	YES ☐ / NO ☑			TYPE ____
16. NOZZLE ORIENTATION	OK ☑			IMPROPER ☐
17. TRAFFIC BOLLARDS	OK ☐ / DAMAGED ☐	N/A ☑		TOO CLOSE ☐

SERVICED BY: [signature]

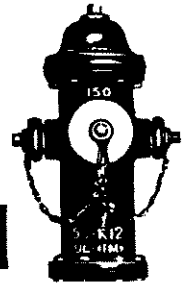
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		
59. OTHER	OK ☐		
60. OTHER	OK ☐		
61. OTHER	OK ☐		
62. OTHER	OK ☐		
63. OTHER	OK ☐		

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
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(416) 282-1665
1-888-349-2493

11

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: North of North American R
HYDRANT MAKE: Century
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED ☐ — OK ☐ NOT VISIBLE ☐ — CLOSED ☐ INOPERABLE ☑
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST — Flowed — PITOT ____ USGPM
9. PRESSURE TEST @ 55 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☑ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

CUSTOMER REPRESENTATIVE:

COMMENTS: Secondary valve seized in open position

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		
59. OTHER	OK ☐		
60. OTHER	OK ☐		
61. OTHER	OK ☐		
62. OTHER	OK ☐		
63. OTHER	OK ☐		

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐

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(416) 282-1665
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17

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: N/E of Special Events Te
HYDRANT MAKE: B50B
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 2' east LOCATED — OK ☑ NOT VISIBLE ☐ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER _____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 40 PITOT 11 76 USGPM
9. PRESSURE TEST @ 50 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR _____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR _____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ BOLID ☑ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION _____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE _____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

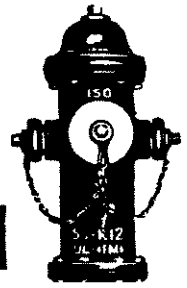
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			☐
59. OTHER	OK ☐			☐
60. OTHER	OK ☐			☐
61. OTHER	OK ☐			☐
62. OTHER	OK ☐			☐
63. OTHER	OK ☐			☐

HYDRANT OPERATION SATISFACTORY ☐
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

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(416) 282-1665
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(13)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: North of Australiasia
HYDRANT MAKE: M67
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 2 least LOCATED — OK ☑ — NOT VISIBLE ☐ — CLOSED ☐ — INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ — O/L ☐ — OK ☑ — DIFFICULT ☐ — LEAKING ☐ — INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ — DRY ☑ — AMT. OF WATER _____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ — LEAKING ☐ — R/S ☑ — LEADED ☐ — LOOSE ☐ — DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 4le PITOT 1261 USGPM
9. PRESSURE TEST @ 56 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ — NO ☑ — COLOUR _____
11. HYDRANT PAINTED — YES ☐ — NO ☑ — COLOUR _____
12. HYDRANT PUMPED OUT — YES ☐ — N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ — SOLID ☑ — BURIED ☐ — N/A ☐ — LEAKING ☐ — DAMAGED ☐
14. REQUIRES BARREL EXTENTION _____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ — NO ☑ — TYPE _____
16. NOZZLE ORIENTATION — OK ☐ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ — DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

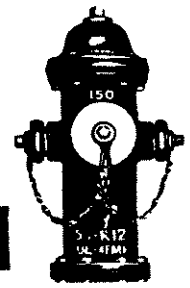
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		
59. OTHER	OK ☐		
60. OTHER	OK ☐		
61. OTHER	OK ☐		
62. OTHER	OK ☐		
63. OTHER	OK ☐		

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



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Scarborough, On. M1E 4V1
(416) 282-1665
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(14)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: North of Australasia Area
HYDRANT MAKE: M&H
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 4" LOCATED — OK ☑ — NOT VISIBLE ☐ — CLOSED ☐ — INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — P/S ☐ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 26 PITOT 948 USGPM
9. PRESSURE TEST @ 56 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☑ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: Max

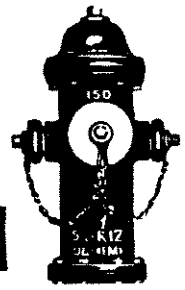
CUSTOMER REPRESENTATIVE:

COMMENTS: Leaks at operating nut packing.

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			☐
59. OTHER	OK ☐			☐
60. OTHER	OK ☐			☐
61. OTHER	OK ☐			☐
62. OTHER	OK ☐			☐
63. OTHER	OK ☐			☐

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

15

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361 A Old Finch Ave Scarborough

HYDRANT LOCATION: South of Greenhouse
HYDRANT MAKE: M67
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	2 Twist LOCATED		OK ☑ NOT VISIBLE ☐		CLOSED ☐ INOPERABLE ☐	
2. HYDRANT OPERATION	O/R ☑ O/L ☐		OK ☑ DIFFICULT ☐		LEAKING ☐ INOPERABLE ☐	
3. CHECK BARREL FOR WATER	WET ☐ DRY ☑	AMT. OF WATER				
4. CHECK CAP GASKETS	OK ☑				REPLACED ☐	
5. CHECK NOZZLES & THREADS	O/K ☑ LEAKING ☐		R/B ☑ LEADED ☐		LOOSE ☐ DAMAGED ☐	
6. LUBRICATE HYDRANT	YES ☑				NOT REQUIRED ☐	
7. LUBE SCREW	OK ☑		MISSING ☐		REPLACED ☐	
8. FLOW TEST 34	PITOT 1085				USGPM	
9. PRESSURE TEST @ 50 PSIG			PASSED ☑		FAILED ☐	
10. COLOUR CODED	YES ☐ NO ☑	COLOUR				
11. HYDRANT PAINTED	YES ☐ NO ☑	COLOUR				
12. HYDRANT PUMPED OUT	YES ☐ N/A ☑				NO ☐	
13. GROUND FLANGE	SAFETY ☑ SOLID ☐		BURIED ☐ N/A ☐		LEAKING ☐ DAMAGED ☐	
14. REQUIRES BARREL EXTENTION					N/A ☐	
15. PUMPER NOZZLE	YES ☑ NO ☐				TYPE ST	
16. NOZZLE ORIENTATION	OK ☑				IMPROPER ☐	
17. TRAFFIC BOLLARDS	OK ☐ DAMAGED ☐		N/A ☑		TOO CLOSE ☐	

SERVICED BY: [signature]

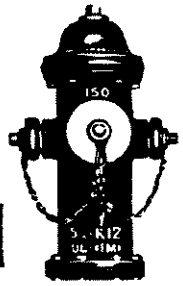
CUSTOMER REPRESENTATIVE:

COMMENTS: Left 2½" inch port cap missing.

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: S/E of north service
HYDRANT MAKE: Mc7
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	3 west LOCATED		OK ☑		CLOSED ☐
			NOT VISIBLE ☐		INOPERABLE ☐
2. HYDRANT OPERATION	O/R ☑		OK ☑		LEAKING ☐
	O/L ☐		DIFFICULT ☐		INOPERABLE ☐
3. CHECK BARREL FOR WATER	WET ☐		AMT. OF WATER		
	DRY ☑				
4. CHECK CAP GASKETS	OK ☑				REPLACED ☐
5. CHECK NOZZLES & THREADS	O/K ☑		R/S ☑		LOOSE ☐
	LEAKING ☐		LEADED ☐		DAMAGED ☐
6. LUBRICATE HYDRANT	YES ☑				NOT REQUIRED ☐
7. LUBE SCREW	OK ☑		MISSING ☐		REPLACED ☐
8. FLOW TEST	30	PITOT	109		USGPM
9. PRESSURE TEST @	50 PSIG		PASSED ☑		FAILED ☐
10. COLOUR CODED	YES ☐		COLOUR		
	NO ☑				
11. HYDRANT PAINTED	YES ☐		COLOUR		
	NO ☑				
12. HYDRANT PUMPED OUT	YES ☐				NO ☐
	N/A ☑				
13. GROUND FLANGE	SAFETY ☐		BURIED ☐		LEAKING ☐
	SOLID ☑		N/A ☐		DAMAGED ☐
14. REQUIRES BARREL EXTENTION					N/A ☐
15. PUMPER NOZZLE	YES ☐				TYPE
	NO ☑				
16. NOZZLE ORIENTATION	OK ☑				IMPROPER ☐
17. TRAFFIC BOLLARDS	OK ☐		N/A ☑		TOO CLOSE ☐
	DAMAGED ☐				

SERVICED BY:

CUSTOMER REPRESENTATIVE:

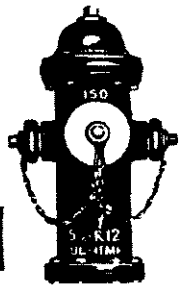
COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58.	OK ☐		☐
59.	OK ☐		☐
60.	OK ☐		☐
61.	OK ☐		☐
62.	OK ☐		☐
63.	OK ☐		☐

all not operated.

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

17

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: N/E of north service
HYDRANT MAKE: M67
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	2 west LOCATED	☑ OK	☐ NOT VISIBLE	☐ CLOSED ☐ INOPERABLE
2. HYDRANT OPERATION	☑ O/R ☐ O/L	☑ OK	☐ DIFFICULT	☐ LEAKING ☐ INOPERABLE
3. CHECK BARREL FOR WATER	☐ WET ☑ DRY	AMT. OF WATER		
4. CHECK CAP GASKETS	☑ OK			☐ REPLACED
5. CHECK NOZZLES & THREADS	☑ OK ☐ LEAKING	☑ R/S	☐ LEADED	☐ LOOSE ☐ DAMAGED
6. LUBRICATE HYDRANT	☑ YES			☐ NOT REQUIRED
7. LUBE SCREW	☑ OK	☐ MISSING		☐ REPLACED
8. FLOW TEST 34	PITOT 1085			USGPM
9. PRESSURE TEST @ 50 PSIG		☑ PASSED		☐ FAILED
10. COLOUR CODED	☐ YES ☑ NO	COLOUR		
11. HYDRANT PAINTED	☐ YES ☑ NO	COLOUR		
12. HYDRANT PUMPED OUT	☐ YES ☑ N/A			☐ NO
13. GROUND FLANGE	☐ SAFETY ☑ SOLID	☐ BURIED ☐ N/A		☐ LEAKING ☐ DAMAGED
14. REQUIRES BARREL EXTENTION				☐ N/A
15. PUMPER NOZZLE	☐ YES ☑ NO	TYPE		
16. NOZZLE ORIENTATION	☑ OK			☐ IMPROPER
17. TRAFFIC BOLLARDS	☐ OK ☐ DAMAGED	☑ N/A		☐ TOO CLOSE

SERVICED BY:

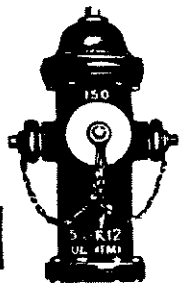
CUSTOMER REPRESENTATIVE:

COMMENTS: Secondary unable to cycle due to depth.

ADDITIONAL WORK

18. BONNET COVER	☐ OK	☐ N/A	☐ REPLACED
19. BONNET BOLTS	☐ OK	☐ N/A	☐ REPLACED
20. BONNET	☐ OK		☐ REPLACED
21. BONNET SEAL	☐ OK		☐ REPLACED
22. OPERATING NUT	☐ OK		☐ REPLACED
23. OPERATING NUT O-RING(S)	☐ OK	☐ N/A	☐ REPACK
24. STUFFING BOX	☐ OK	☐ N/A	☐ REPLACED
25. THRUST BEARING	☐ OK	☐ N/A	☐ REPLACED
26. BEARING HOUSING	☐ OK	☐ N/A	☐ REPLACED
27. BEARING HOUSING BOLTS	☐ OK	☐ N/A	☐ REPLACED
28. HOUSING COVER	☐ OK	☐ N/A	☐ REPLACED
29. HOUSING COVER BOLTS	☐ OK	☐ N/A	☐ REPLACED
30. BEARING HOUSING SEAL(S)	☐ OK	☐ N/A	☐ REPLACED
31. UPPER OPERATING ROD	☐ OK		☐ REPLACED
32. LOWER OPERATING ROD	☐ OK		☐ REPLACED
33. ROD COUPLING	☐ OK	☐ N/A	☐ REPLACED
34. COUPLING BOLTS	☐ OK	☐ N/A	☐ REPLACED
35. LOWER ROD NUT(S)	☐ OK		☐ REPLACED
36. LOWER ROD STOP PIN/PLATE	☐ OK	☐ N/A	☐ REPLACED
37. VALVE BALL SEAL(S)	☐ OK	☐ N/A	☐ REPLACED
38. VALVE BALL BOTTOM	☐ OK		☐ REPLACED
39. VALVE BALL RUBBER	☐ OK		☐ REPLACED
40. VALVE BALL TOP	☐ OK	☐ N/A	☐ REPLACED
41. MAIN VALVE SEAT	☐ OK		☐ REPLACED
42. MAIN VALVE SEAT SEAL(S)	☐ OK		☐ REPLACED
43. DRAIN VALVE	☐ OK		☐ REPLACED
44. DRAIN VALVE SEAL(S)	☐ OK		☐ REPLACED
45. DRAIN VALVE PORT(S)	☐ OK	☐ CLEARED	☐ REPLACED
46. DRAIN VALVE COTTER PIN(S)	☐ OK	☐ N/A	☐ REPLACED
47. LOWER BARREL	☐ OK		☐ REPLACED
48. LOWER BARREL FLANGE(S)	☐ OK	☐ N/A	☐ REPLACED
49. UPPER BARREL	☐ OK		☐ REPLACED
50 UPPER BARREL FLANGE(S)	☐ OK	☐ N/A	☐ REPLACED
51. BARREL EXTENTION(S)	☐ OK	☐ N/A	☐ REPLACED
52. FLANGE GASKET(S)	☐ OK	☐ N/A	☐ REPLACED
53. FLANGE BOLTS	☐ OK	☐ N/A	☐ REPLACED
54. BOOT	☐ OK	☐ N/A	☐ REPLACED
55. NOZZLE(S)	☐ OK	☐ RECAULKED	☐ REPLACED
56. NOZZLE CAP(S)	☐ OK		☐ REPLACED
57. NOZZLE RETAINER(S)	☐ OK	☐ N/A	☐ REPLACED
58. OTHER	☐ OK		
59. OTHER	☐ OK		
60. OTHER	☐ OK		
61. OTHER	☐ OK		
62. OTHER	☐ OK		
63. OTHER	☐ OK		

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

18

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: East side of garage
HYDRANT MAKE: Canron
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 2' South LOCATED ☑ — OK ☑ — NOT VISIBLE ☐ — CLOSED ☐ — INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER _____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☑ 1
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST — 23 — PITOT — 892 — USGPM
9. PRESSURE TEST @ 48 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR _____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR _____
12. HYDRANT PUMPED OUT — YES ☑ N/A ☐ — NO ☐
13. GROUND FLANGE — SAFETY ☑ SOLID ☐ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION _____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE _____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

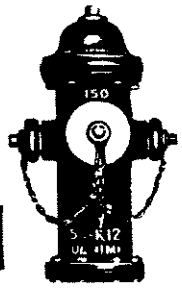
CUSTOMER REPRESENTATIVE:

COMMENTS: Secondary valve box broken & lid missing (4SL) Also box has mud, but still operable. N/D

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. [illegible]	OK ☐		
59. [illegible]	OK ☐		
60. [illegible]	OK ☐		
61. [illegible]	OK ☐		
62. [illegible]	OK ☐		
63. [illegible]	OK ☐		

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

19

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough
HYDRANT LOCATION: West end of North serv
HYDRANT MAKE: Century
DATE: Dec 21/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	3 north LOCATED		OK ☑ NOT VISIBLE ☐		CLOSED ☐ INOPERABLE ☐	
2. HYDRANT OPERATION	O/R ☑ O/L ☐		OK ☑ DIFFICULT ☐		LEAKING ☐ INOPERABLE ☐	
3. CHECK BARREL FOR WATER	WET ☐ DRY ☑	AMT. OF WATER				
4. CHECK CAP GASKETS	OK ☑				REPLACED ☐	
5. CHECK NOZZLES & THREADS	O/K ☑ LEAKING ☐		R/S ☑ LEADED ☐		LOOSE ☐ DAMAGED ☐	
6. LUBRICATE HYDRANT	YES ☑				NOT REQUIRED ☐	
7. LUBE SCREW	OK ☑		MISSING ☐		REPLACED ☐	
8. FLOW TEST	26	PITOT	948		USGPM	
9. PRESSURE TEST @	50 PSIG		PASSED ☐		FAILED ☐	
10. COLOUR CODED	YES ☐ NO ☑	COLOUR				
11. HYDRANT PAINTED	YES ☐ NO ☑	COLOUR				
12. HYDRANT PUMPED OUT	YES ☐ N/A ☑				NO ☐	
13. GROUND FLANGE	SAFETY ☐ SOLID ☑		BURIED ☐ N/A ☐		LEAKING ☐ DAMAGED ☐	
14. REQUIRES BARREL EXTENTION					N/A ☐	
15. PUMPER NOZZLE	YES ☐ NO ☑				TYPE	
16. NOZZLE ORIENTATION	OK ☑				IMPROPER ☐	
17. TRAFFIC BOLLARDS	OK ☐ DAMAGED ☐		N/A ☑		TCC CLOSE ☐	

SERVICED BY:

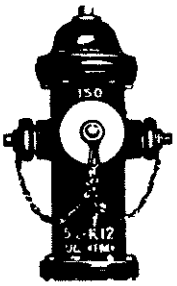
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			
59. OTHER	OK ☐			
60. OTHER	OK ☐			
61. OTHER	OK ☐			
62. OTHER	OK ☐			
63. OTHER	OK ☐			

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

20

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: East of New Zion Holdin
HYDRANT MAKE: AVK
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE ____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☐ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 22 PITOT 87.2 USGPM
9. PRESSURE TEST @ 55 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☑ SOLID ☐ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☑ NO ☐ — TYPE ST
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

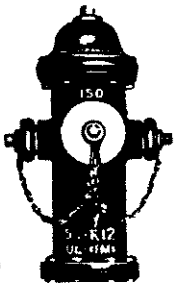
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. [illegible]	OK ☐		
59. [illegible]	OK ☐		
60. [illegible]	OK ☐		
61. [illegible]	OK ☐		
62. [illegible]	OK ☐		
63. [illegible]	OK ☐		

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

(21)

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: Old Matagaska Restaur
HYDRANT MAKE: M67
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 4" South — LOCATED ☐ NOT VISIBLE ☐ — OK ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☐ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 14 — PITOT 69lo — USGPM
9. PRESSURE TEST @ 46 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ BOLID ☑ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			☐
59. OTHER	OK ☐			☐
60. OTHER	OK ☐			☐
61. OTHER	OK ☐			☐
62. OTHER	OK ☐			☐
63. OTHER	OK ☐			☐

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐

A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

22

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: North American Domain
HYDRANT MAKE: Mc7
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — 4' north — LOCATED — OK ☑ — NOT VISIBLE ☐ — CLOSED ☐ — INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ — O/L ☐ — OK ☑ — DIFFICULT ☐ — LEAKING ☐ — INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ — DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ — LEAKING ☐ — P/S ☑ — LEADED ☐ — LOOSE ☐ — DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST — 12 — PITOT — 64 — USGPM
9. PRESSURE TEST @ 93 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ — NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ — NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ — N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ — SOLID ☐ — BURIED ☑ — N/A ☐ — LEAKING ☐ — DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ — NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ — DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

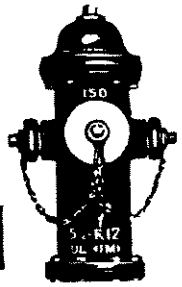
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
36. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58.	OK ☐			☐
59.	OK ☐			☐
60.	OK ☐			☐
61.	OK ☐			☐
62.	OK ☐			☐
63.	OK ☐			☐

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: New Savana Restaura
HYDRANT MAKE: AVK
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE ____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☐ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 20 PITOT 83.2 USGPM
9. PRESSURE TEST @ 38 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☑ SOLID ☐ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☑ NO ☐ — TYPE ST
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐

A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: North of Cheetah Building
HYDRANT MAKE: AVK
DATE: Dec 23 98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE ____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 14 — PITOT 69lb — USGPM
9. PRESSURE TEST @ 34 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☑ SOLID ☐ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☑ NO ☐ — TYPE ST
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

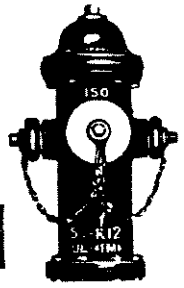
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58.	OK ☐		☐
59.	OK ☐		☐
60.	OK ☐		☐
61.	OK ☐		☐
62.	OK ☐		☐
63.	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☐
HYDRANT OPERATION DEFICIENCY ☐



A-1 HYDRANT SERVICES LTD.

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1-888-349-2493

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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 3611 Old Finch Ave Scarborough

HYDRANT LOCATION: East of African Pavilion
HYDRANT MAKE: Century
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE ____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 18 — PITOT 789 — USGPM
9. PRESSURE TEST @ 32 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — BAFETY ☐ SOLID ☐ — BURIED ☑ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

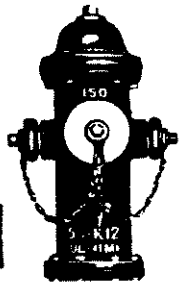
CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50 UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐



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Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

26

CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: East of Society
HYDRANT MAKE: Mueller
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE	3 West LOCATED	OK ☑	CLOSED ☐	
		NOT VISIBLE ☐	INOPERABLE ☑	
2. HYDRANT OPERATION	O/R ☑	OK ☑	LEAKING ☐	
	O/L ☐	DIFFICULT ☐	INOPERABLE ☐	
3. CHECK BARREL FOR WATER	WET ☐	AMT. OF WATER ____		
	DRY ☑			
4. CHECK CAP GASKETS	OK ☑		REPLACED ☐	
5. CHECK NOZZLES & THREADS	O/K ☑	R/S ☑	LOOSE ☐	
	LEAKING ☐	LEADED ☐	DAMAGED ☐	
6. LUBRICATE HYDRANT	YES ☑		NOT REQUIRED ☐	
7. LUBE SCREW	OK ☑	MISSING ☐	REPLACED ☐	
8. FLOW TEST	Flushed	PITOT ____	USGPM	
9. PRESSURE TEST @ 120 PSIG		PASSED ☑	FAILED ☐	
10. COLOUR CODED	YES ☐	COLOUR ____		
	NO ☑			
11. HYDRANT PAINTED	YES ☐	COLOUR ____		
	NO ☑			
12. HYDRANT PUMPED OUT	YES ☐		NO ☐	
	N/A ☑			
13. GROUND FLANGE	SAFETY ☑	BURIED ☐	LEAKING ☐	
	SOLID ☐	N/A ☐	DAMAGED ☐	
14. REQUIRES BARREL EXTENTION ____			N/A ☐	
15. PUMPER NOZZLE	YES ☐		TYPE ____	
	NO ☑			
16. NOZZLE ORIENTATION	OK ☑		IMPROPER ☐	
17. TRAFFIC BOLLARDS	OK ☐	N/A ☑	TOO CLOSE ☐	
	DAMAGED ☐			

SERVICED BY: [signature]

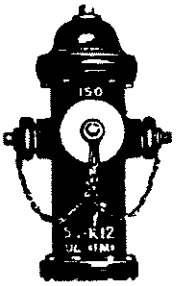
CUSTOMER REPRESENTATIVE:

COMMENTS: Hydrant unable to flow test due to walkways. Secondary inoperable due to valve box full of dirt.

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PINPLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY
HYDRANT OPERATION DEFICIENCY



A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
(416) 282-1665
1-888-349-2493

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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION: South of Society
HYDRANT MAKE: Mueller
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE ____ LOCATED — OK ☐ NOT VISIBLE ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 54 — PITOT 1367 — USGPM
9. PRESSURE TEST @ 58 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☑ SOLID ☐ — BURIED ☐ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☑ DAMAGED ☐ — N/A ☐ — TOO CLOSE ☐

SERVICED BY: [signature]

CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐		REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐		REPLACED ☐
20. BONNET	OK ☐			REPLACED ☐
21. BONNET SEAL	OK ☐			REPLACED ☐
22. OPERATING NUT	OK ☐			REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐		REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐		REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐		REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐		REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐		REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐		REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐		REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
31. UPPER OPERATING ROD	OK ☐			REPLACED ☐
32. LOWER OPERATING ROD	OK ☐			REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐		REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐		REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐			REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐		REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐		REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐			REPLACED ☐
39. VALVE BALL RUBBER	OK ☐			REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐		REPLACED ☐
41. MAIN VALVE SEAT	OK ☐			REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐			REPLACED ☐
43. DRAIN VALVE	OK ☐			REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐			REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐		REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐		REPLACED ☐
47. LOWER BARREL	OK ☐			REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
49. UPPER BARREL	OK ☐			REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐		REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐		REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐		REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐		REPLACED ☐
54. BOOT	OK ☐	N/A ☐		REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐		REPLACED ☐
56. NOZZLE CAP(S)	OK ☐			REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐		REPLACED ☐
58. OTHER	OK ☐			
59. OTHER	OK ☐			
60. OTHER	OK ☐			
61. OTHER	OK ☐			
62. OTHER	OK ☐			
63. OTHER	OK ☐			

HYDRANT OPERATION SATISFACTORY ☑
HYDRANT OPERATION DEFICIENCY ☐

A-1 HYDRANT SERVICES LTD.

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(416) 282-1665
1-888-349-2493

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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave Scarborough

HYDRANT LOCATION:
HYDRANT MAKE: Mc7
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED: N/VE ☐ NOT VISIBLE ☐ — OK ☑ — CLOSED ☐ INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ O/L ☐ — OK ☑ DIFFICULT ☐ — LEAKING ☐ INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — OK ☑ LEAKING ☐ — R/S ☑ LEADED ☐ — LOOSE ☐ DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST — Elevated — PITOT ____ USGPM
9. PRESSURE TEST @ 60 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ SOLID ☐ — BURIED ☑ N/A ☐ — LEAKING ☐ DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

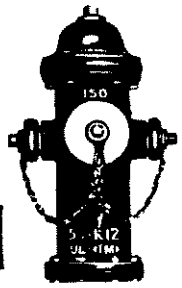
CUSTOMER REPRESENTATIVE:

COMMENTS: Hydrant unable to flow test due temperature & bath-ways

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

HYDRANT OPERATION SATISFACTORY ☐
HYDRANT OPERATION DEFICIENCY ☐



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Scarborough, On. M1E 4V1
(416) 282-1665
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CUSTOMER NAME: Toronto Metro Zoo
SERVICE ADDRESS: 361A Old Finch Ave, Scarborough

HYDRANT LOCATION: West of Parrot Cage
HYDRANT MAKE: M67
DATE: Dec 23/98

ANNUAL PREVENTATIVE MAINTENANCE (APM)

1. SECONDARY VALVE — LOCATED ☐ — OK ☐ / NOT VISIBLE ☑ — CLOSED ☐ / INOPERABLE ☐
2. HYDRANT OPERATION — O/R ☑ / O/L ☐ — OK ☑ / DIFFICULT ☐ — LEAKING ☐ / INOPERABLE ☐
3. CHECK BARREL FOR WATER — WET ☐ / DRY ☑ — AMT. OF WATER ____
4. CHECK CAP GASKETS — OK ☑ — REPLACED ☐
5. CHECK NOZZLES & THREADS — O/K ☑ / LEAKING ☐ — R/S ☑ / LEADED ☐ — LOOSE ☐ / DAMAGED ☐
6. LUBRICATE HYDRANT — YES ☑ — NOT REQUIRED ☐
7. LUBE SCREW — OK ☑ — MISSING ☐ — REPLACED ☐
8. FLOW TEST 30 PITOT 10/9 USGPM
9. PRESSURE TEST @ 44 PSIG — PASSED ☑ — FAILED ☐
10. COLOUR CODED — YES ☐ / NO ☑ — COLOUR ____
11. HYDRANT PAINTED — YES ☐ / NO ☑ — COLOUR ____
12. HYDRANT PUMPED OUT — YES ☐ / N/A ☑ — NO ☐
13. GROUND FLANGE — SAFETY ☐ / SOLID ☐ — BURIED ☑ / N/A ☐ — LEAKING ☐ / DAMAGED ☐
14. REQUIRES BARREL EXTENTION ____ — N/A ☐
15. PUMPER NOZZLE — YES ☐ / NO ☑ — TYPE ____
16. NOZZLE ORIENTATION — OK ☑ — IMPROPER ☐
17. TRAFFIC BOLLARDS — OK ☐ / DAMAGED ☐ — N/A ☑ — TOO CLOSE ☐

SERVICED BY: [signature]

CUSTOMER REPRESENTATIVE:

COMMENTS:

ADDITIONAL WORK

18. BONNET COVER	OK ☐	N/A ☐	REPLACED ☐
19. BONNET BOLTS	OK ☐	N/A ☐	REPLACED ☐
20. BONNET	OK ☐		REPLACED ☐
21. BONNET SEAL	OK ☐		REPLACED ☐
22. OPERATING NUT	OK ☐		REPLACED ☐
23. OPERATING NUT O-RING(S)	OK ☐	N/A ☐	REPACK ☐
24. STUFFING BOX	OK ☐	N/A ☐	REPLACED ☐
25. THRUST BEARING	OK ☐	N/A ☐	REPLACED ☐
26. BEARING HOUSING	OK ☐	N/A ☐	REPLACED ☐
27. BEARING HOUSING BOLTS	OK ☐	N/A ☐	REPLACED ☐
28. HOUSING COVER	OK ☐	N/A ☐	REPLACED ☐
29. HOUSING COVER BOLTS	OK ☐	N/A ☐	REPLACED ☐
30. BEARING HOUSING SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
31. UPPER OPERATING ROD	OK ☐		REPLACED ☐
32. LOWER OPERATING ROD	OK ☐		REPLACED ☐
33. ROD COUPLING	OK ☐	N/A ☐	REPLACED ☐
34. COUPLING BOLTS	OK ☐	N/A ☐	REPLACED ☐
35. LOWER ROD NUT(S)	OK ☐		REPLACED ☐
36. LOWER ROD STOP PIN/PLATE	OK ☐	N/A ☐	REPLACED ☐
37. VALVE BALL SEAL(S)	OK ☐	N/A ☐	REPLACED ☐
38. VALVE BALL BOTTOM	OK ☐		REPLACED ☐
39. VALVE BALL RUBBER	OK ☐		REPLACED ☐
40. VALVE BALL TOP	OK ☐	N/A ☐	REPLACED ☐
41. MAIN VALVE SEAT	OK ☐		REPLACED ☐
42. MAIN VALVE SEAT SEAL(S)	OK ☐		REPLACED ☐
43. DRAIN VALVE	OK ☐		REPLACED ☐
44. DRAIN VALVE SEAL(S)	OK ☐		REPLACED ☐
45. DRAIN VALVE PORT(S)	OK ☐	CLEARED ☐	REPLACED ☐
46. DRAIN VALVE COTTER PIN(S)	OK ☐	N/A ☐	REPLACED ☐
47. LOWER BARREL	OK ☐		REPLACED ☐
48. LOWER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
49. UPPER BARREL	OK ☐		REPLACED ☐
50. UPPER BARREL FLANGE(S)	OK ☐	N/A ☐	REPLACED ☐
51. BARREL EXTENTION(S)	OK ☐	N/A ☐	REPLACED ☐
52. FLANGE GASKET(S)	OK ☐	N/A ☐	REPLACED ☐
53. FLANGE BOLTS	OK ☐	N/A ☐	REPLACED ☐
54. BOOT	OK ☐	N/A ☐	REPLACED ☐
55. NOZZLE(S)	OK ☐	RECAULKED ☐	REPLACED ☐
56. NOZZLE CAP(S)	OK ☐		REPLACED ☐
57. NOZZLE RETAINER(S)	OK ☐	N/A ☐	REPLACED ☐
58. OTHER	OK ☐		☐
59. OTHER	OK ☐		☐
60. OTHER	OK ☐		☐
61. OTHER	OK ☐		☐
62. OTHER	OK ☐		☐
63. OTHER	OK ☐		☐

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 10:15 am

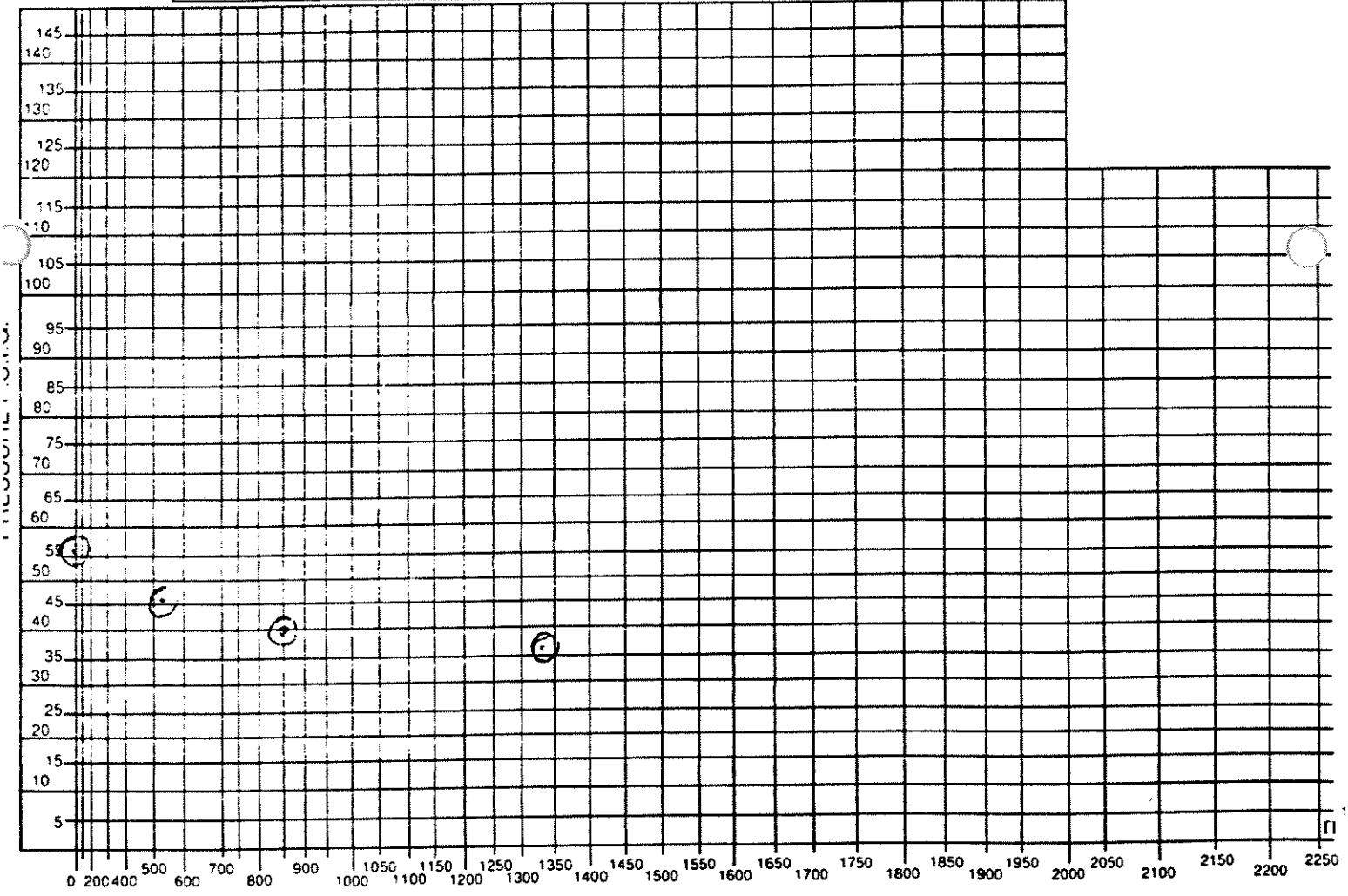
LOCATION OF TEST: (FLOW) Hydrant (Australasia McDonalds) #14

(RESIDUAL) Hydrant (north end of Australasia Building) #1

MAIN SIZE 4" & 8" inch

STATIC PRESSURE 56 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	41	525	46
#2	1 X 2 1/2"	26	852	40
#3	2 X 2 1/2"	16	1336	36
#4				



COMMENTS FLOW TEST - BCUK

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 3161A Old Finch Ave

TEST DATA

TIME OF TEST 9:00 am

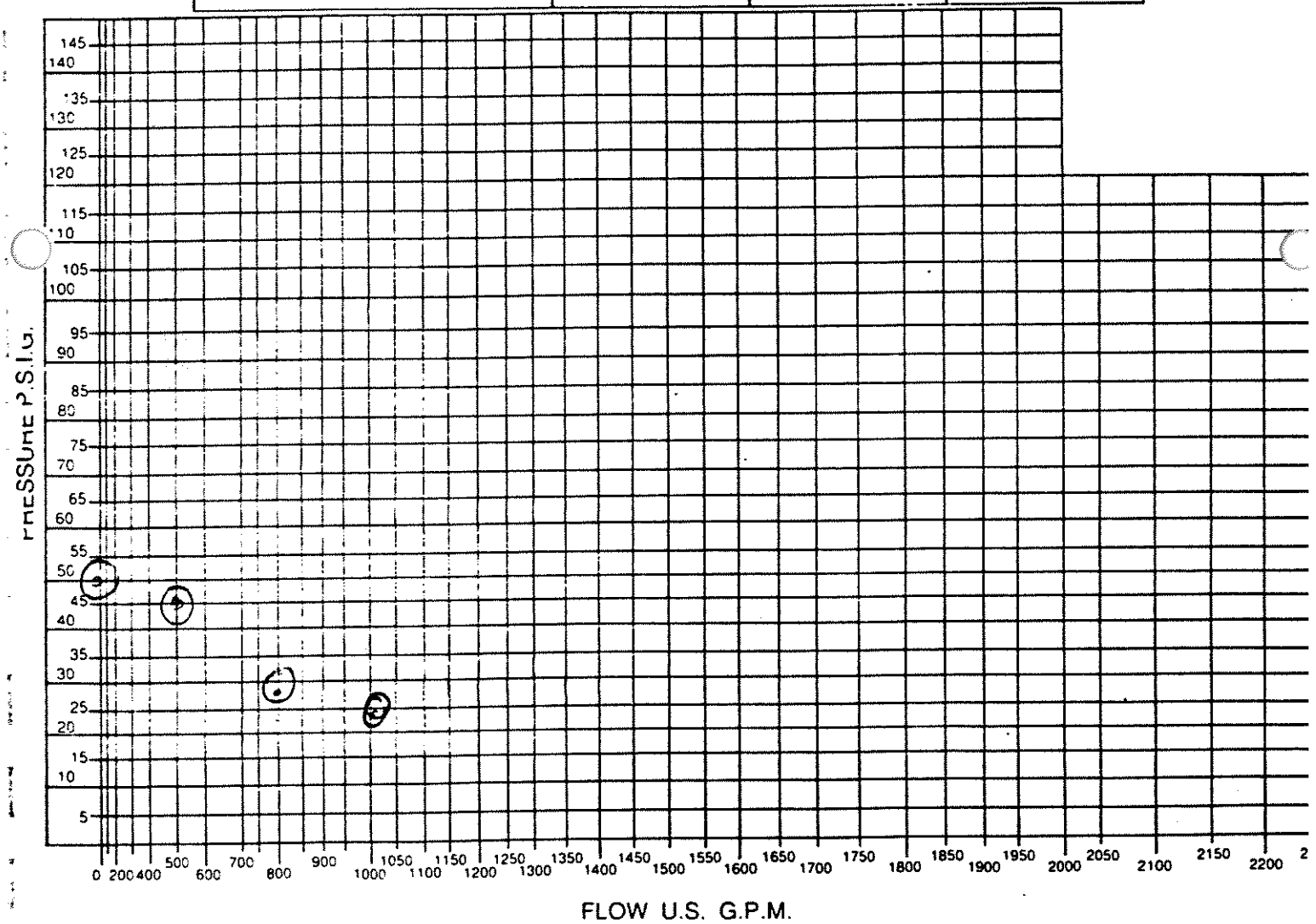
LOCATION OF TEST: (FLOW) Hydrant (East side of garage) #18

(RESIDUAL) Hydrant (West end of north service) #19

MAIN SIZE 6" inch

STATIC PRESSURE 50 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 x 1 3/4"	40	518	45
#2	1 x 2 1/2"	23	800	28
#3	2 x 2 1/2"	11	1108	25
#4				



COMMENTS Flow test - Green

Authorized Signature _____ A-1 HYDRANT Signature

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 11:00am

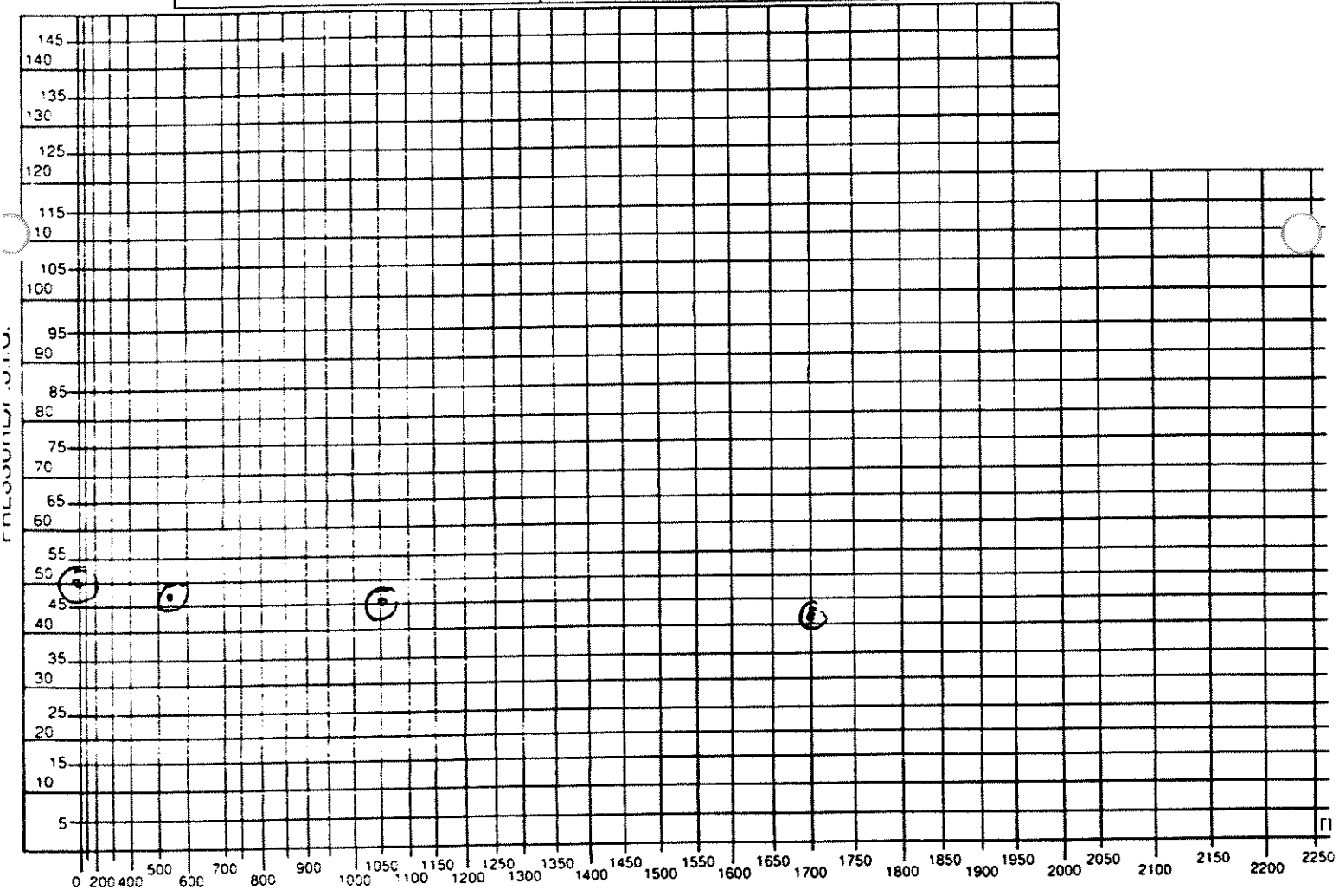
LOCATION OF TEST (FLOW) Hydrant (N/E of Special Events Tent) #12

(RESIDUAL) 3/4 hose bib (Siberian Tiger building) ✓

MAIN SIZE 4" inch

STATIC PRESSURE 50 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S G P M)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	44	1744	47
#2	1 X 2 1/2"	40	1056	45
#3	2 X 2 1/2"	26	1703	42
#4				



FLOW U.S. G.P.M.

COMMENTS FLOW TEST - BLUE.

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME: Toronto Metro Zoo DATE: Dec 21/98

LOCATION: 361A Old Finch Ave

TEST DATA

TIME OF TEST: 11:30 am

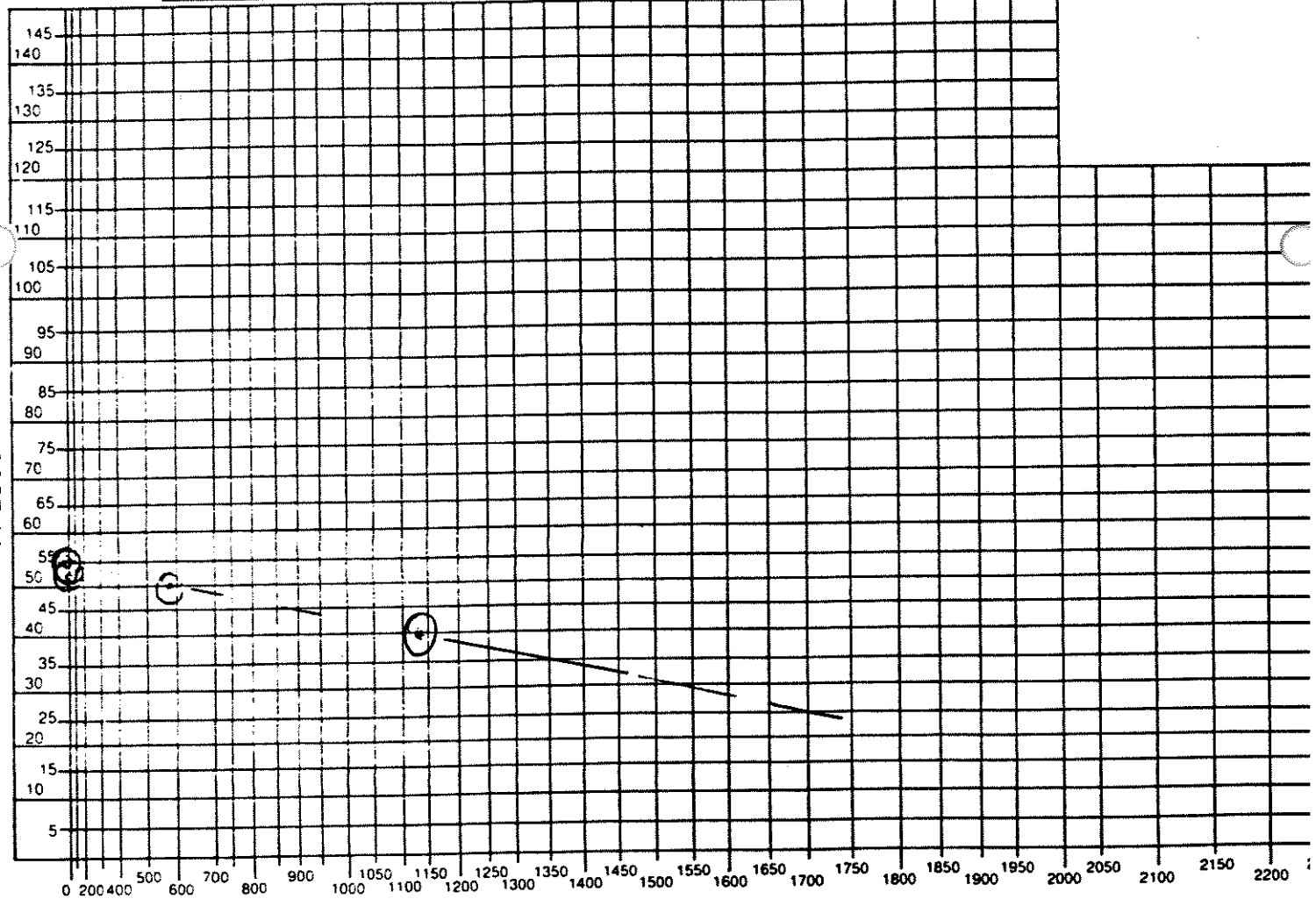
LOCATION OF TEST: (FLOW) Hydrant (West of ~~American~~ North American Mc Donald's) #10

(RESIDUAL) Hydrant (North of North American Pavillion) #11

MAIN SIZE: 8" inch

STATIC PRESSURE: 55 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	52	591	50
#2	1 X 2 1/2"	46	1133	40
#3				
#4				



COMMENTS: Unable to flow 2X2 1/2" inch due to surroundings. - FLOW TEST - Bluff

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 12:00 pm

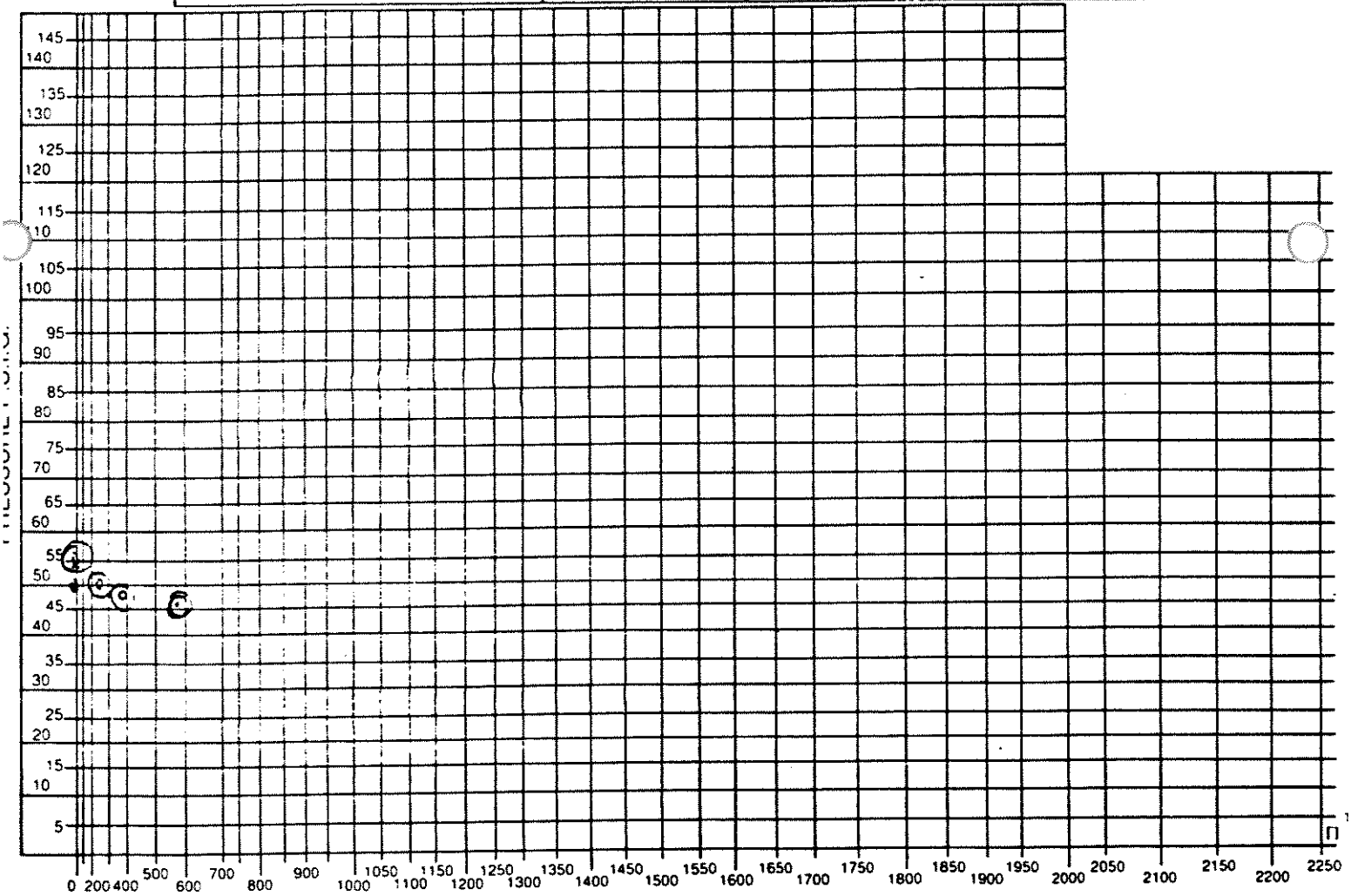
LOCATION OF TEST: (FLOW) Hydrant (Outside holding area) #9

(RESIDUAL) Hydrant (South end of main temple) #8

MAIN SIZE 6" & 4" inch

STATIC PRESSURE 56 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	9	246	50
#2	1 X 2 1/2"	5	373	48
#3	2 X 2 1/2"	3	578	46
#4				



COMMENTS FLOW TEST - FLOW HYDRANT - RED
RES. HYDRANT - BLUE OR GREEN

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.

550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE: Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 1:00 pm

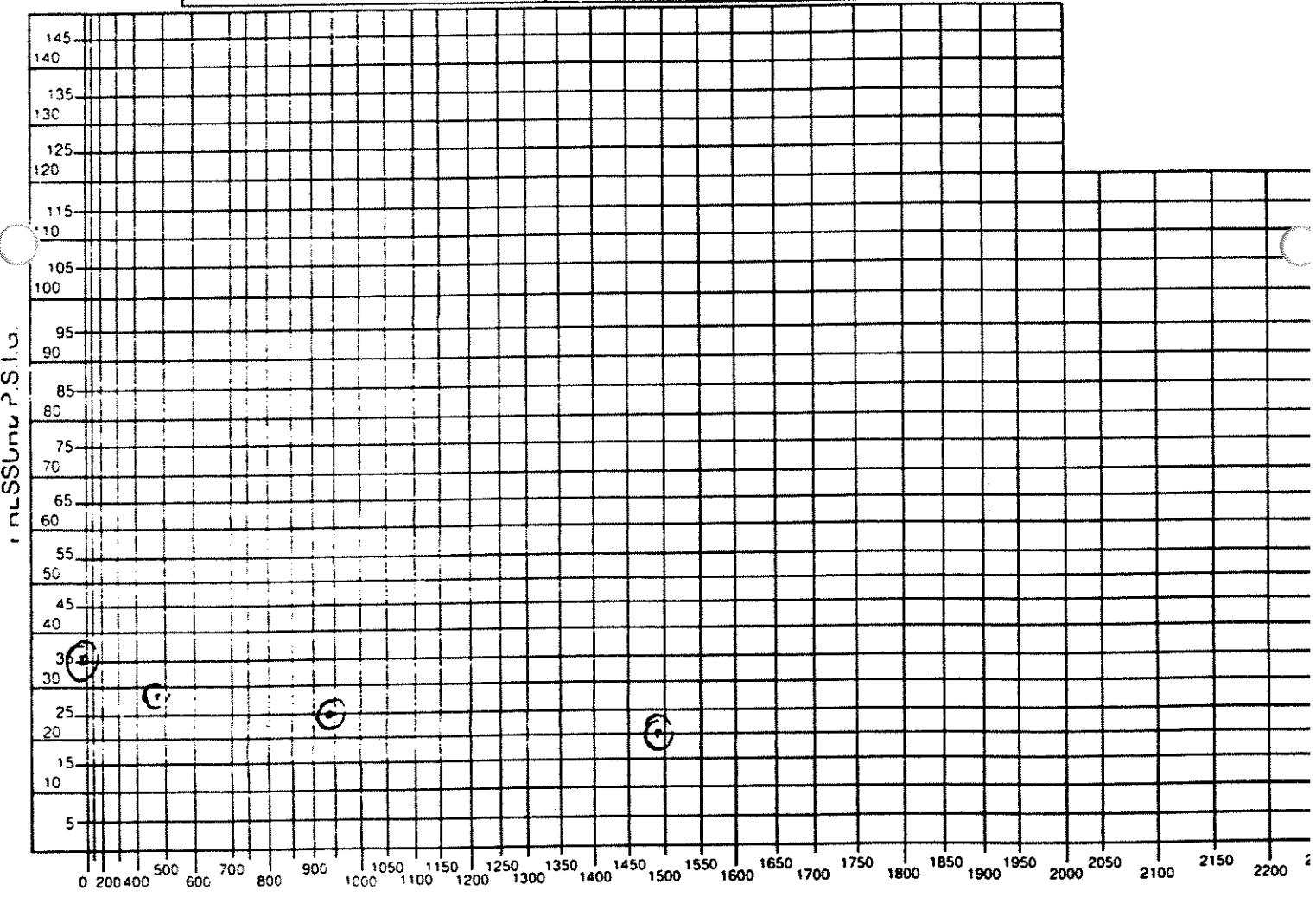
LOCATION OF TEST: (FLOW) Hydrant (n/w of African McDonald's) #7

(RESIDUAL) Hydrant (south of African McDonald's) #6

MAIN SIZE 6 inch

STATIC PRESSURE: 35 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	34	478	28
#2	1 X 2 1/2"	32	945	25
#3	2 X 2 1/2"	20	1494	20
#4				



COMMENTS Flow Test - Green

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST: 1:45 pm

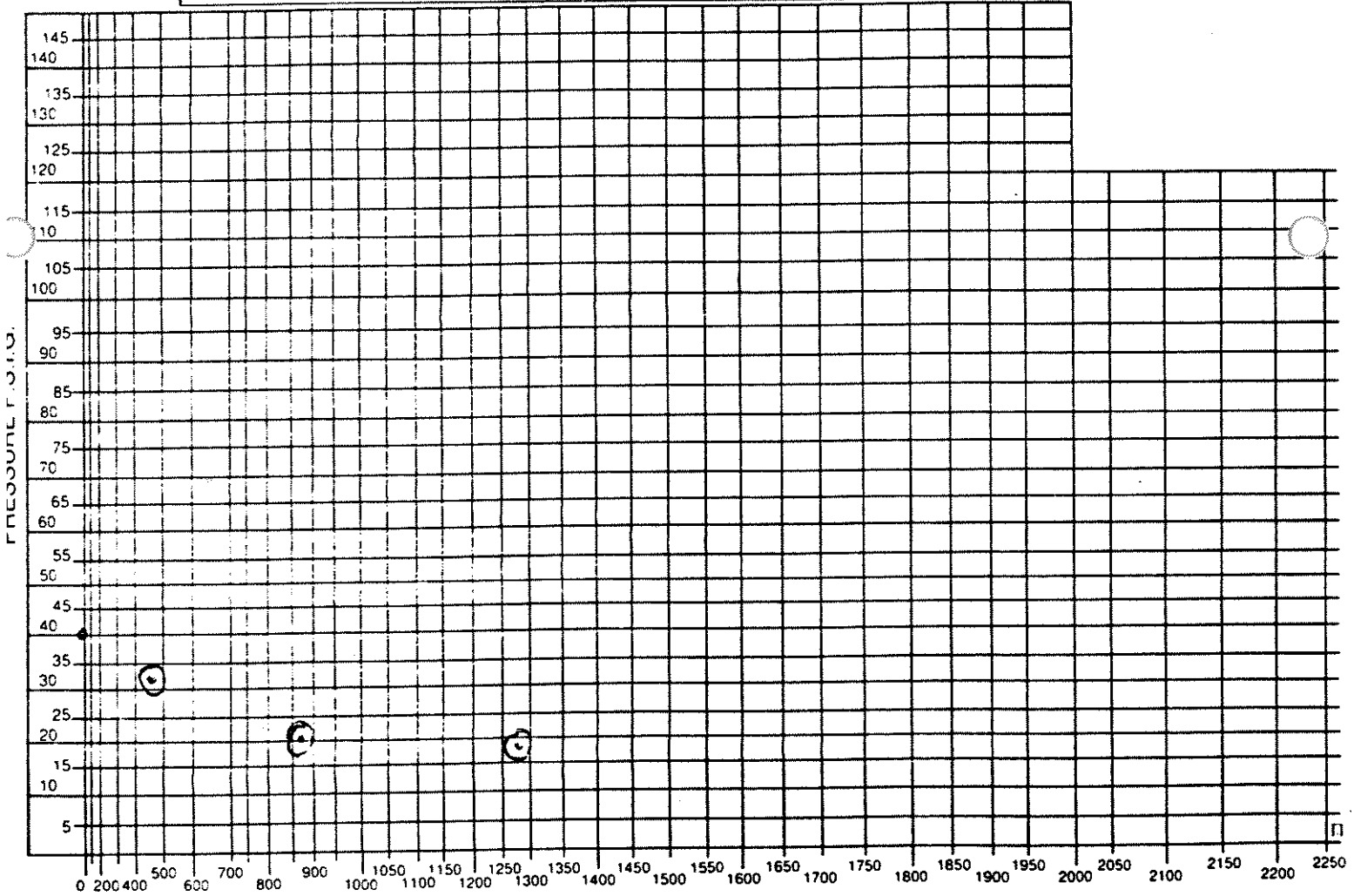
LOCATION OF TEST: (FLOW) Hydrant (Outside gorilla door) #4

(RESIDUAL) Hydrant (West side of African Pavilion) #5

MAIN SIZE 10" inch

STATIC PRESSURE 40

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	32	463	32
#2	1 X 2 1/2"	27	868	20
#3	2 X 2 1/2"	15	1294	28
#4				



FLOW U.S. G.P.M.

COMMENTS FLOW TEST - ONE GATE / GREEN

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 3:50 pm

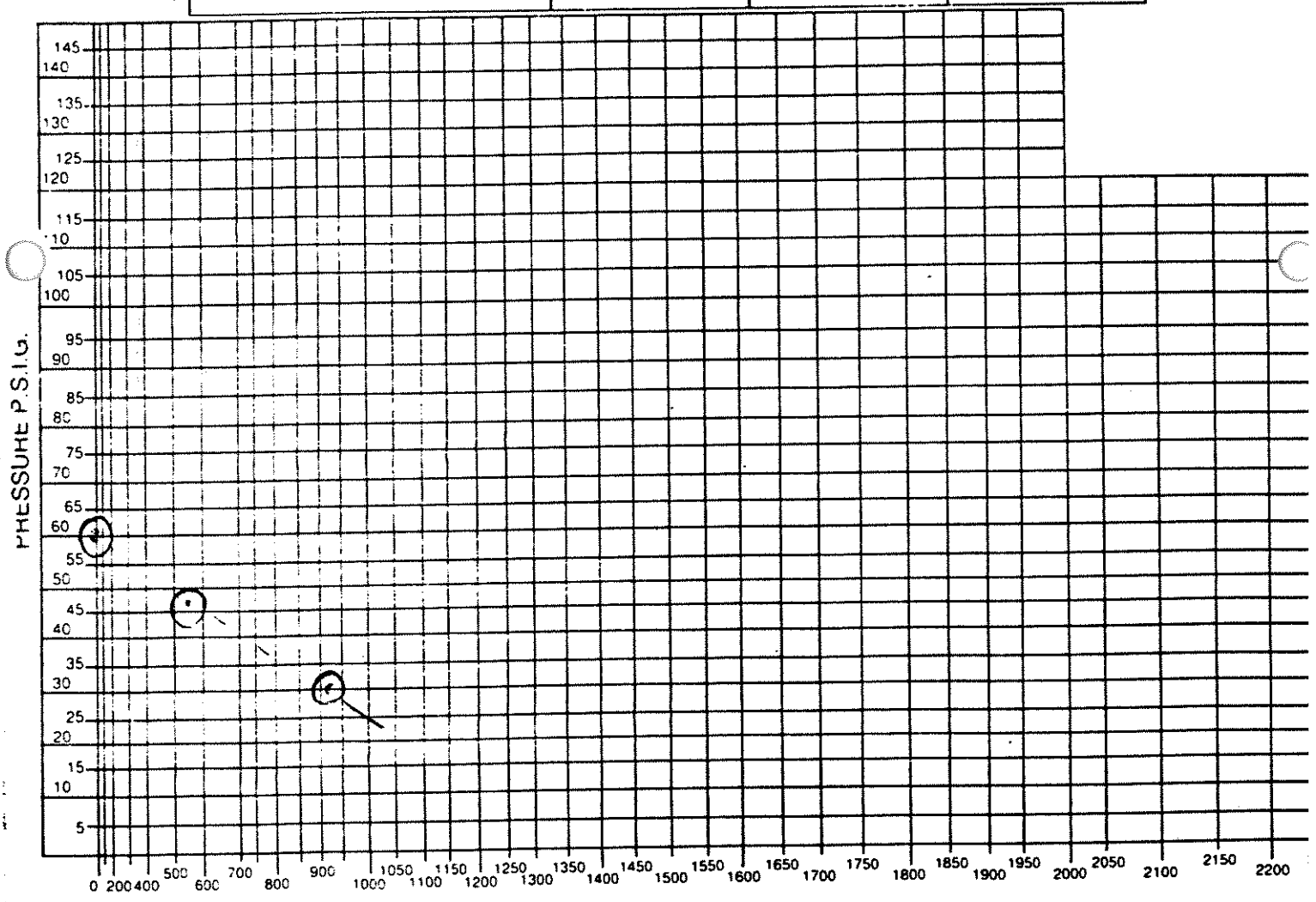
LOCATION OF TEST: (FLOW) Hydrant (West of Indian Rino building) #1

(RESIDUAL) 3/4" hose bib (Inside Indian Rino building) #

MAIN SIZE 6" inch

STATIC PRESSURE 60 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	46	556	47
#2	1 X 2 1/2"	30	914	30
#3				
#4				



COMMENTS FLOW TEST - GREEN

Authorized Signature _____ A-1 HYDRANT Signature

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 23/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 10:30am

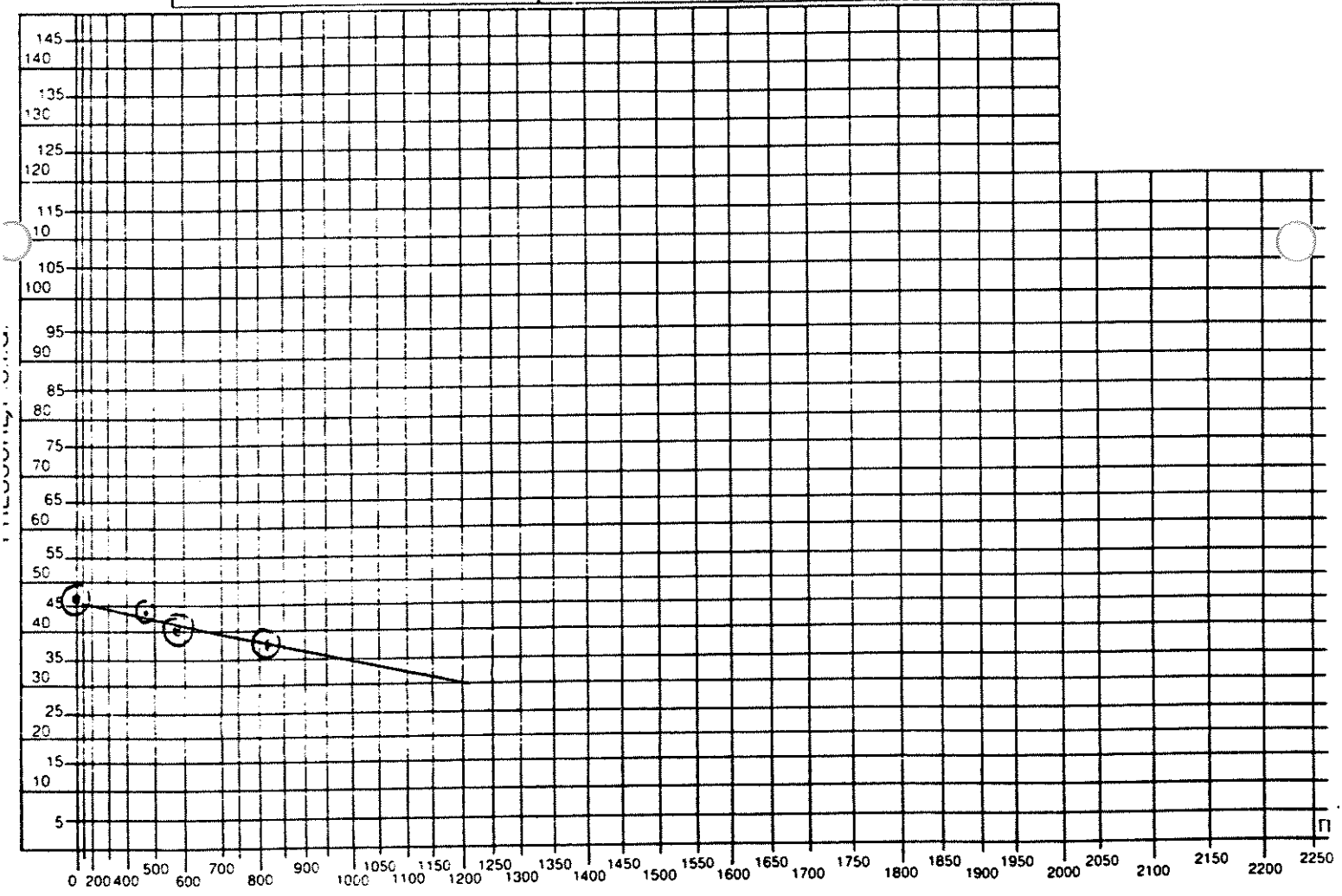
LOCATION OF TEST (FLOW) Hydrant (North American Domain) #22

(RESIDUAL) Hydrant (South of Old Mataqaska Restaurant) #21

MAIN SIZE 4" inch

STATIC PRESSURE 46 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	83	471	44
#2	1 X 2 1/2"	12	580	40
#3	2 X 2 1/2"	60	820	38
#4				



COMMENTS FLOW TEST - FLOW HYD - ORANGE
RES HYD - GREEN BLUE

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 23/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 8:45 a.m.

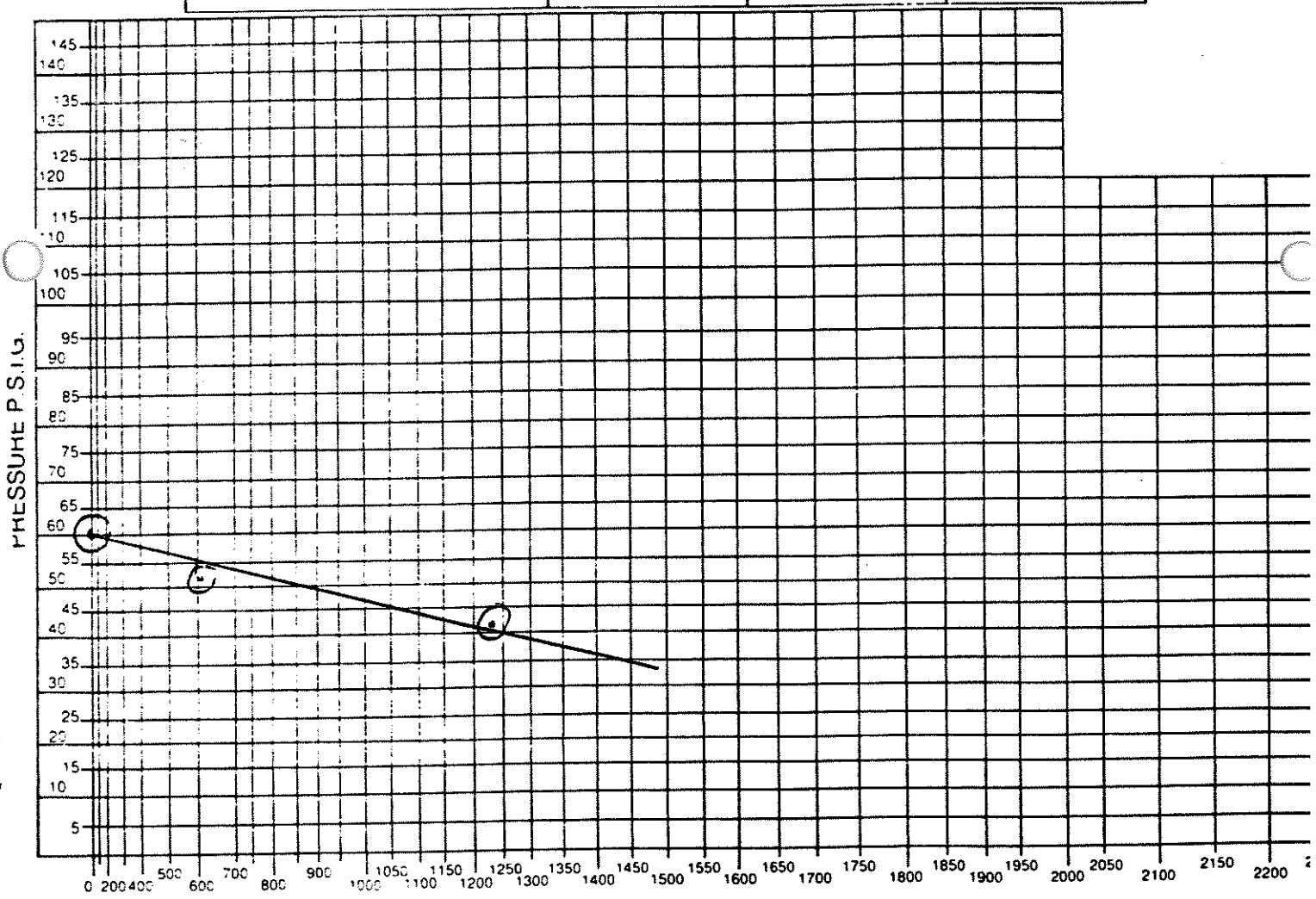
LOCATION OF TEST. (FLOW) Hydrant (East of Society) #26

(RESIDUAL) Hydrant (South of Society) #27

MAIN SIZE 6" inch

STATIC PRESSURE 60 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1 3/4"	54	602	52
#2	1 X 2 1/2"	54	1230	42
#3				
#4				



COMMENTS FLOW TEST — BLUE.

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 23/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 10:00am

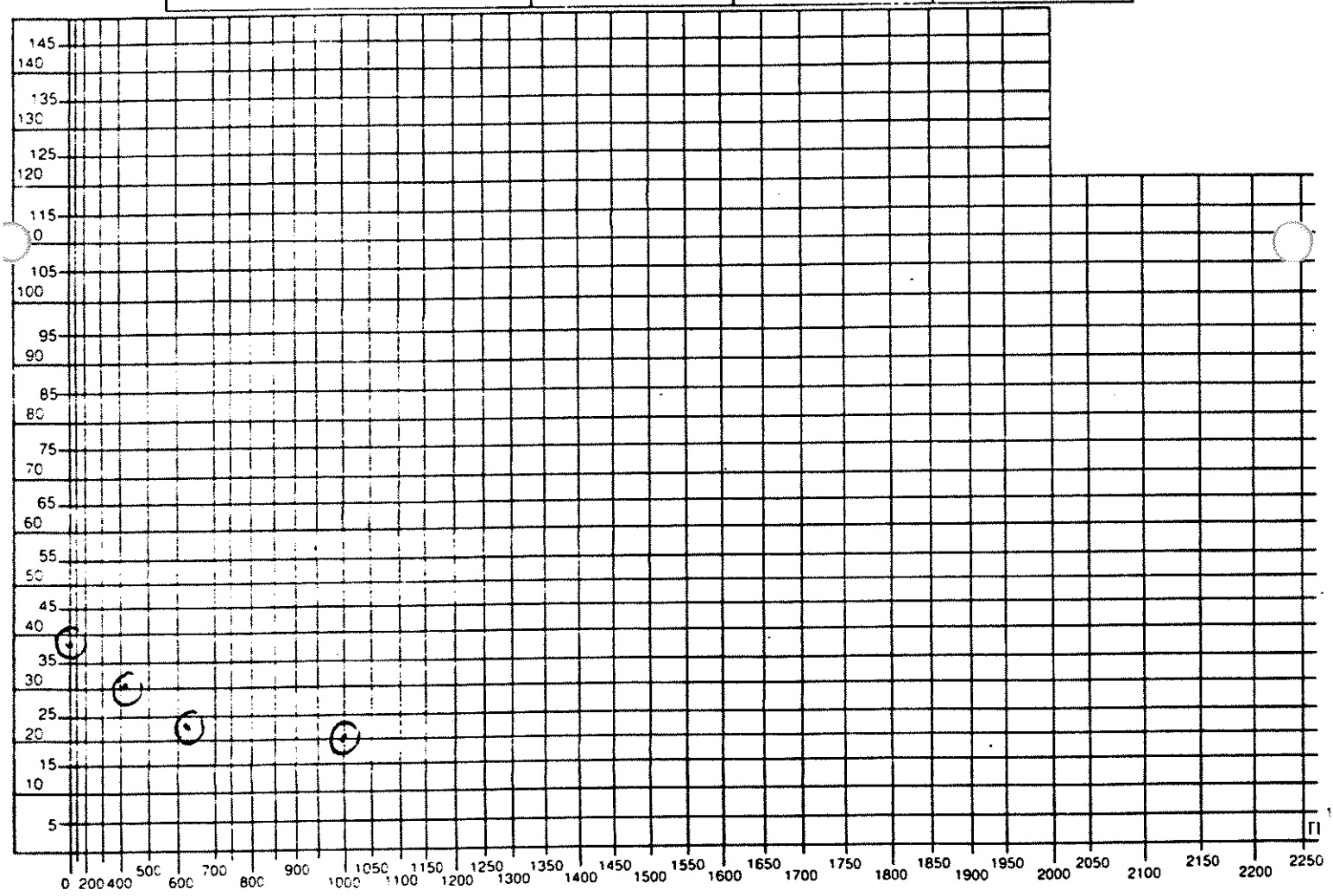
LOCATION OF TEST: (FLOW) Hydrant (North of Cheetah Building) #24

(RESIDUAL) Hydrant (New Lavana Restaurant) #23

MAIN SIZE 4" inch

STATIC PRESSURE 38 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 X 1¾"	26	417	30
#2	1 X 2½"	14	626	24
#3	2 X 2½"	9	1004	20
#4				



COMMENTS FLOW TEST - FLOW HYD - ORANGE

Authorized Signature _____ A-1 HYDRANT Signature _____

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit #18
Scarborough, Ont. M1E 4V1
282-1665

SITE NAME Toronto Metro Zoo DATE Dec 21/98

LOCATION 361A Old Finch Ave

TEST DATA

TIME OF TEST 9:20 am

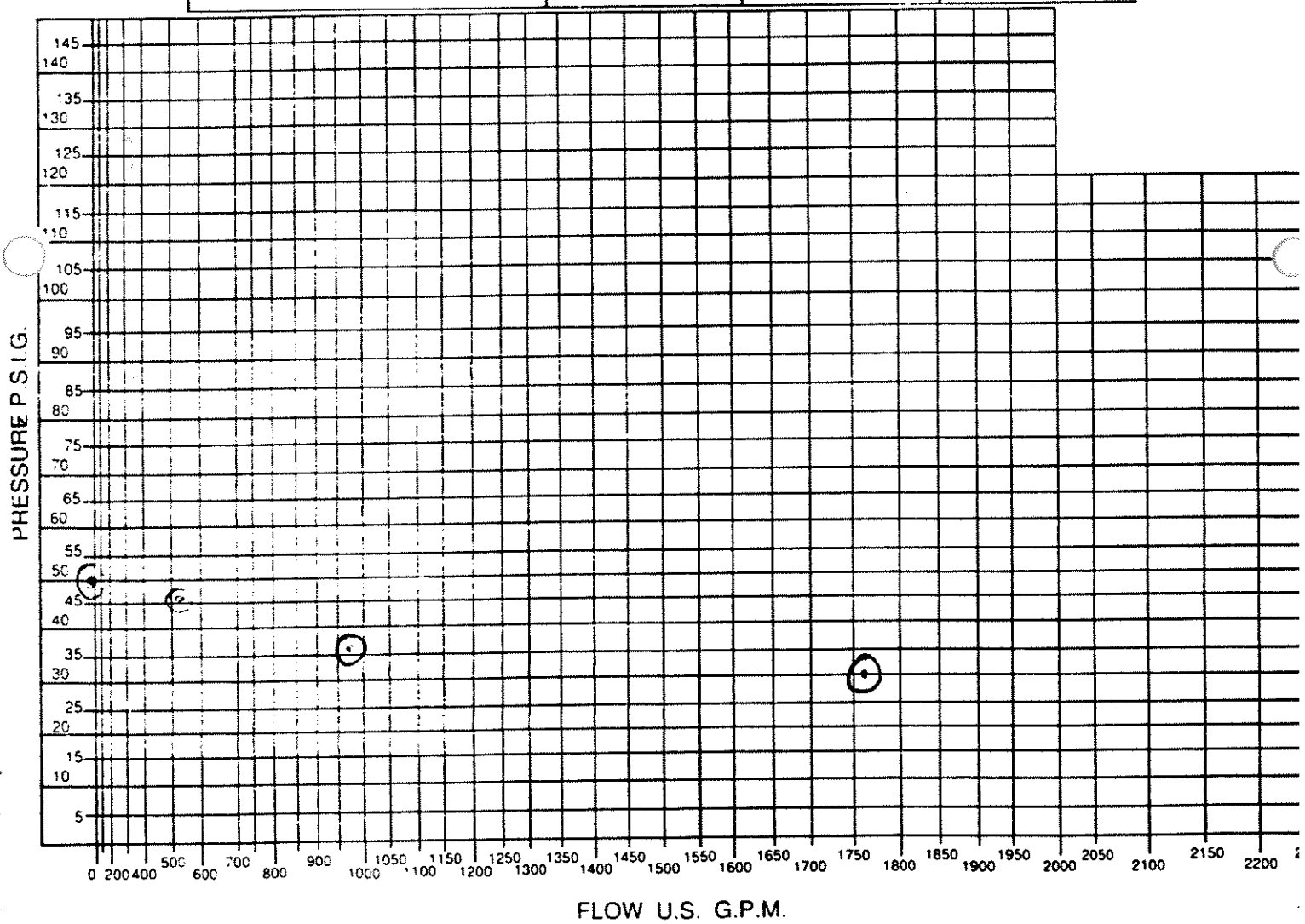
LOCATION OF TEST (FLOW) Hydrant (W/E of north service) #17

(RESIDUAL) Hydrant (S/E of north service) #16

MAIN SIZE 8" inch

STATIC PRESSURE 50 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S.G.P.M.)	RESIDUAL PRESSURE
#1	1 x 1 3/4"	41	525	46
#2	1 x 2 1/2"	34	974	36
#3	2 x 2 1/2"	28	1767	30
#4				



COMMENTS Flow TEST - BLUE

Authorized Signature _____ A-1 HYDRANT Signature

A-1 HYDRANT SERVICES LTD.
550 Coronation Dr., Unit # 18
Scarborough, On. M1E 4V1
TEL: (416) 282-1665
FAX: (416) 282-7702
1-888-FIX-A-HYD

Metro Toronto Zoo c/o
Paradigm Engineering Ltd.
1300 Don Mills Road, Suite 235,
North York, ON
M3B 2W6

Attention: Mr. Doug Shields
416-444-5211
416-444-9222

INVOICE#:	H9159-1
DATE:	December 30/98
Customers'#:	D.Shields
OUR JOB#:	H9159
G.S.T. #:	R100371152
P.S.T.#:	85685569
TERMS:	NET 15 DAYS

DESCRIPTION	AMOUNT	TOTAL
LOCATION: Metro Toronto Zoo		
To bill for the following:		
12 flow tests at $75.00 each	900.00	
29 hydrant a.p.m.'s at $40.00 each	1,160.00	
	2,060.00	
G.S.T.	144.20	
TOTAL AMOUNT DUE:		$ 2,204.20

APPENDIX 8

GAS TEST RESULTS

INVOICE

4204

Trade Gas Services (Toronto) Ltd.
29 Golden Gate Court
SCARBOROUGH, ONTARIO M1P 3A4

(416) 293-6742 Fax (416) 293-6765
GST #R105339410

TO

PARADIGM ENGINEERING GROUP INC.
1300 Don Mills Road, Suite 235
North York, Ont. M3B 2W6

DATE Jan 5. 1999 JOB NO.
JOB NAME Metro Zoo
JOB LOCATION

QUANTITY	DESCRIPTION	PRICE	AMOUNT
	Test checked gas supply lines as requested by		
	Paradigm Engineering Group Inc.		
	Indo-Malaya Pavilion #1 Test		
	To determin the static pressure and working pressure		
	at three points (branch lines) of the gas service.		
	11 M meter with Fisher Type 133L-3 Reg.		
	Max inlet 60 P.S.I.		
	Max outlet 2 P.S.I.		
	2 - National Champion Furnaces 4,350.000 each.		
	1 - Pool heater Hayward H-250 250,000 BTU each		
	1 - DHW Aerco heater 1,000,000 BTU each		
	1 - Pool heater Hayward H-150 150,000 BTU each		
	Shut off each appliance, shut gas valve at meter		
	and tested pressure + 43 P.S.I.		
	Shut off appliances, shut gas, removed gage and		
	started appliances again.		
	North Main Service Bldg. #2 Test.		
	7 M meter with Fisher type S203 Reg. 3/4" Orf.		
	1 - Eng. Air HE40 (Paint Shop) 250,000 BTU each		
	2 - Teledyne Laars HB-3000 3,000,000 BTU each		
	2 - Teledyne Laars HB-3500 3,500,000 BTU each		
	4 - Rheem Ruud RF76-Z50C (DHW) 250,000 BTU each		
	2 - Rheem Ruud PV40-36M (DHW) 36,000 BTU each		
	Shut off each appliance, shut off gas valve at meter		

TERMS:

Cont.....

SUBTOTAL	
GST	
PST	
TOTAL	

THANK YOU

INVOICE

rade Gas Services (Toronto) Ltd.
29 Golden Gate Court
SCARBOROUGH, ONTARIO M1P 3A4

(416) 293-6742 Fax (416) 293-6765
GST #R105339410

INVOICE # 4204

TO

DATE _____ JOB NO. _____

JOB NAME _____

JOB LOCATION _____

QUANTITY	DESCRIPTION	PRICE	AMOUNT
	and tested static pressure = 44 P.S.I.		
	Started appliances and tested working pressure = 40 P.S.I.		
	Shut off appliances, shut gas at meter and removed gage.		
	Opened gas at meter and relit pilots.		
	Started appliances up again.		
	Consumers Gas Main Station #3 Test.		
	Removed plug on test point at station.		
	Installed gage and checked pressure = 44 P.S.I.		
	Removed gage and installed plug.		

APPENDIX 9

WATER TEST RESULTS

APPENDIX 10

SANITARY SEWER TEST RESULTS (PRINT)

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: NONE GIVEN

DATE: Jan 26 1999
TIME: 09:11:07

INSP. BY:	F.H.	REF. AREA:	WO #1685
DISK No:	01FH	FILE NAME:	TVI91773.RPT
TAPE No:	01FH	TAPE COUNT:	00:00:00
PIPE SIZE:	375mm	PIPE TYPE:	SANITARY/AC
FLOW DIR:	North	CAMERA DIR:	Against Flow

STARTING LOCATION:	ENDING LOCATION:
3RD MH N OF THE INDO PAVILLION	2ND MH N OF THE INDO PAVILLION
PIPE DEPTH:4.0m	PIPE DEPTH:N/A-NO ACCESS

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
03	TOTAL: 32.0 Metres	02
	FLOW DIRECTION <----	

Summary Comments

LIGHT DEBRIS UNDER THE FLOW.

Distance At	To	Inspection Comments
0.0		Starting manhole - 03
1.5		Moderate steam hampering inspection
32.0		Ending manhole - 02
32.0		End of inspection

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: NONE GIVEN

DATE: Jan 26 1999
TIME: 09:40:11

INSP. BY:	F.H.	REF. AREA:	WO #1685
DISK No:	01FH	FILE NAME:	TVI91774.RPT
TAPE No:	01FH	TAPE COUNT:	00:02:25
PIPE SIZE:	375mm	PIPE TYPE:	SANITARY/AC
FLOW DIR:	North	CAMERA DIR:	Against Flow

STARTING LOCATION:	ENDING LOCATION:
2ND MH N OF THE INDO PAVILLION	1ST MH N OF THE INDO PAVILLION
PIPE DEPTH:N/A-NO ACCESS	PIPE DEPTH:N/A-NO ACCESS

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
02	TOTAL: 63.5 Metres	01
	FLOW DIRECTION <----	

Summary Comments

EXTRA MH NOT SHOWN ON THE MAP.LIGHT
DEBRIS IN THE LINE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 02
0.0	7.0	Light debris in line - Invert
7.0		Extra manhole not shown
63.6		Ending manhole - 01
63.5		Ending manhole - 01
63.5		End of inspection

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: NONE GIVEN

DATE: Jan 26 1999
TIME: 10:14:35

INSP. BY: F.H.	REF. AREA: WO #1685
DISK No: 01FH	FILE NAME: TVI91775.RPT
TAPE No: 01FH	TAPE COUNT: 00:06:50
PIPE SIZE: 200mm	PIPE TYPE: SANITARY/AC
FLOW DIR: West	CAMERA DIR: Against Flow

STARTING LOCATION:	ENDING LOCATION:
EAST OF THE OLD ELEPHANT HOUSE	FENCE LINE OF OLD ELELPHNT HOUSE
PIPE DEPTH:3.4m	PIPE DEPTH:N/A-NO ACCESS

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 51.0 Metres	ENDING MANHOLE
04		05

FLOW DIRECTION <----

Summary Comments

LIGHT CALCITE AT A SERVICE CONNECTION.

Distance At	To	Inspection Comments
0.0		Starting manhole - 04
3.4		Light calcite at service connection - 2 O'clock
51.0		Ending manhole - 05
51.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: NONE GIVEN

DATE: Jan 26 1999
TIME: 10:36:17

INSP. BY:	F.H.	REF. AREA:	WO #1685
DISK No:	01FH	FILE NAME:	TVI91776.RPT
TAPE No:	01FH	TAPE COUNT:	00:12:55
PIPE SIZE:	200mm	PIPE TYPE:	SANITARY/AC
FLOW DIR:	West	CAMERA DIR:	Against Flow

STARTING LOCATION:	ENDING LOCATION:
FENCE LINE OF OLD ELEPHANT HOUSE	ELEPHANT WATERING HOLE
PIPE DEPTH:N/A-NO ACCESS	PIPE DEPTH:N/A-NO ACCESS

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 66.0 Metres	ENDING MANHOLE
05		06

FLOW DIRECTION <----

Summary Comments

THE PIPE APPEARS TO BE IN GOOD CONDITION

Distance At	To	Inspection Comments
0.0		Starting manhole - 05
66.0		Ending manhole - 06
66.0		End of inspection

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: NONE GIVEN

DATE: Jan 26 1999
TIME: 10:43:06

INSP. BY:	F.H.	REF. AREA:	WO #1685
DISK No:	01FH	FILE NAME:	TVI91777.RPT
TAPE No:	01FH	TAPE COUNT:	00:17:10
PIPE SIZE:	200mm	PIPE TYPE:	SANITARY/AC
FLOW DIR:	West	CAMERA DIR:	Against Flow

STARTING LOCATION:	ENDING LOCATION:
ELEPHANT WATERING HOLE	BUSH CAMP
PIPE DEPTH:N/A-NO ACCESS	PIPE DEPTH:N/A-NO ACCESS

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
06	TOTAL: 70.0 Metres	07
	FLOW DIRECTION <----	

Summary Comments

THE PIPE APPEARS TO BE IN GOOD CONDITION

Distance At	To	Inspection Comments
0.0		Starting manhole - 06
70.0		Ending manhole - 07
70.0		End of inspection

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: MAIN PARKING LOT "P" SECTION

DATE: Jan 26 1999
TIME: 11:50:34

INSP. BY:	F.H.	REF. AREA:	WO #1685
DISK No:	01FH	FILE NAME:	TVI91778.RPT
TAPE No:	01FH	TAPE COUNT:	00:21:55
PIPE SIZE:	525mm	PIPE TYPE:	SANITARY/AC
FLOW DIR:	East	CAMERA DIR:	With Flow

STARTING LOCATION:
2ND MH E OF THE RIVER
PIPE DEPTH:5.3m

ENDING LOCATION:
1ST MH E OF THE RIVER
PIPE DEPTH:N/A-NO ACCESS

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
08	TOTAL: 92.5 Metres	09
	FLOW DIRECTION ---->	

Summary Comments

LIGHT DEBRIS UNDER THE FLOW.

Distance At	To	Inspection Comments
0.0		Starting manhole - 08
92.5		Ending manhole - 09
92.5		End of inspection

Trans-Video Inspection Limited
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: MAIN PARKING LOT "P" SECTION

DATE: Jan 26 1999
TIME: 12:26:58

INSP. BY:	F.H.	REF. AREA:	WO #1685
DISK No:	01FH	FILE NAME:	TVI91779.RPT
TAPE No:	01FH	TAPE COUNT:	00:26:05
PIPE SIZE:	525mm	PIPE TYPE:	SANITARY/AC
FLOW DIR:	East	CAMERA DIR:	With Flow

STARTING LOCATION:
1ST MH E OF THE RIVER
PIPE DEPTH:N/A-NO ACCESS

ENDING LOCATION:
1ST MH W OF THE RIVER
PIPE DEPTH:N/A-NO ACCESS

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
09	TOTAL: 81.0 Metres	10
	FLOW DIRECTION ---->	

Summary Comments

LIGHT DEBRIS UNDER THE FLOW.

Distance At	To	Inspection Comments
0.0		Starting manhole - 09
81.0		Ending manhole - 10
81.0		End of inspection

APPENDIX 11

SANITARY SEWER TEST RESULTS (VIDEO)

APPENDIX 12

STORM SEWER TEST RESULTS (PRINT)

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: "D" GATE SOUTH OF OLD FINCH RD

DATE: Feb 5 1999
TIME: 08:22:26

INSP. BY:	F.H.	REF. AREA:	
DISK No:	02FH	FILE NAME:	TVI90517.RPT
TAPE No:	02FH	TAPE COUNT:	00:00:00
PIPE SIZE:	675mm	PIPE TYPE:	STORM/CONC
FLOW DIR:	South	CAMERA DIR:	With Flow

STARTING LOCATION:
NORTH OF GATE "D"
PIPE DEPTH:2.5m

ENDING LOCATION:
SOUTH OF GATE "D"
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 59.5 Metres	ENDING MANHOLE
01		02

FLOW DIRECTION ---->

Summary Comments

PONDING AND DEBRIS IN THE LINE.HEAVY
CALCITE BELOW A SERVICE CONNECTION.

Distance At	To	Inspection Comments
0.0		Starting manhole - 01
1.5	48.4	Moderate ponding in line
4.9	9.1	Moderate debris in line - Invert
9.1		Service connection - 11 O'clock
9.1		Service protruding greater than 1" - 2 O'clock
14.2	58.2	Moderate debris in line - Invert
26.0		Service connection - 11 O'clock
26.0	26.0	Heavy calcite in line - 8 O'clock
26.9		Service connection - Crown
36.8		Service connection - 11 O'clock
48.4		Service connection - 1 O'clock
59.5		Ending manhole - 02
59.5		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: "D" GATE SOUTH OF OLD FINCH RD

DATE: Feb 5 1999
TIME: 09:11:29

INSP. BY:	F.H.	REF. AREA:	
DISK No:	02FH	FILE NAME:	TVI90518.RPT
TAPE No:	02FH	TAPE COUNT:	00:06:05
PIPE SIZE:	675mm	PIPE TYPE:	STORM/CONC
FLOW DIR:	South	CAMERA DIR:	With Flow

STARTING LOCATION:
SOUTH OF GATE "D"
PIPE DEPTH:N/A

ENDING LOCATION:
2ND MH S OF OF "D" GATE
PIPE DEPTH:N/A

CAMERA DIRECTION ----->

STARTING MANHOLE	TOTAL: 46.0 Metres	ENDING MANHOLE
02		03

FLOW DIRECTION ----->

Summary Comments

LIGHT PONDING IN THE LINE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 02
1.1		Service connection - 11 O'clock
6.7		Service connection - 11 O'clock
6.7	13.7	Light ponding in line
15.1		Service connection - Crown
17.6		Service connection - Crown
23.7		Service connection - 2 O'clock
31.2		Service connection - 11 O'clock
46.0		Ending manhole - 03
46.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: "D" GATE SOUTH OF OLD FINCH RD

DATE: Feb 5 1999
TIME: 09:19:08

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 675mm
FLOW DIR: South

REF. AREA:
FILE NAME: TVI90519.RPT
TAPE COUNT: 00:10:50
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
2ND MH S OF OF "D" GATE
PIPE DEPTH:N/A

ENDING LOCATION:
3RD MH S OF OF "D" GATE
PIPE DEPTH:N/A

CAMERA DIRECTION ----->

STARTING MANHOLE	TOTAL: 40.0 Metres	ENDING MANHOLE
03		04

FLOW DIRECTION ----->

Summary Comments

MH LID IN THE ENDING MH.

Distance At	To	Inspection Comments
0.0		Starting manhole - 03
19.6	38.3	Light ponding in line
40.0		MH LID IN THE
40.0		Ending manhole - 04
40.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: "D" GATE SOUTH OF OLD FINCH RD

DATE: Feb 5 1999
TIME: 09:38:42

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 675mm
FLOW DIR: South

REF. AREA:
FILE NAME: TVI90520.RPT
TAPE COUNT: 00:10:50
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
2ND MH S OF OF "D" GATE
PIPE DEPTH:N/A

ENDING LOCATION:
3RD MH S OF OF "D" GATE
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: ------.- Metres	ENDING MANHOLE
03		04

FLOW DIRECTION ---->

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 8

DATE: Feb 5 1999
TIME: 09:39:24

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 600mm
FLOW DIR: East

REF. AREA:
FILE NAME: TVI90521.RPT
TAPE COUNT: 00:13:25
PIPE TYPE: STORM/CONC
CAMERA DIR: Against Flow

STARTING LOCATION:
1ST MH W OF EURASIA PAV.
PIPE DEPTH:3.3m

ENDING LOCATION:
N OF NORTH AMERICAN PAV.
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 67.0 Metres	ENDING MANHOLE
05		06

FLOW DIRECTION <----

Summary Comments

LIGHT DEBRIS AND PONDING IN THE LINE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 05
33.1	60.9	Light debris in line - Invert
35.5		Service connection - 9 O'clock
54.4		Service connection - 10 O'clock
60.9	65.4	Moderate ponding in line
67.0		Ending manhole - 06
67.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 8

DATE: Feb 5 1999
TIME: 09:52:20

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 675mm
FLOW DIR: East

REF. AREA:
FILE NAME: TVI90522.RPT
TAPE COUNT: 00:18:20
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
1ST MH W OF EURASIA PAV.
PIPE DEPTH:3.3m

ENDING LOCATION:
@ URASIA PAV.
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 70.0 Metres	ENDING MANHOLE
05		07

FLOW DIRECTION ---->

Summary Comments

LIGHT PONDING AND DEBRIS IN THE LINE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 05
1.5	19.0	Light ponding in line
8.7	19.8	Moderate debris in line - Invert
46.4		Service connection - 2 O'clock
67.5		Internal drop in pipe
70.0		Ending manhole - 07
70.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 8

DATE: Feb 5 1999
TIME: 10:19:52

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 900mm
FLOW DIR: East

REF. AREA:
FILE NAME: TVI90523.RPT
TAPE COUNT: 00:18:20
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
@ URASIA PAV.
PIPE DEPTH:3.6m

ENDING LOCATION:
EAST OF MH 07
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 74.0 Metres	ENDING MANHOLE
07		08

FLOW DIRECTION ---->

Summary Comments

THE PIPE APPEARS TO BE IN GOOD CONDITION

Distance At	To	Inspection Comments
0.0		Starting manhole - 07
3.3		Service connection - 10 O'clock
8.9		Service connection - 2 O'clock
24.0		Service connection - 3 O'clock
27.9		Service connection - 10 O'clock
74.0		Ending manhole - 08
74.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 8

DATE: Feb 5 1999
TIME: 10:27:06

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 900mm
FLOW DIR: East

REF. AREA:
FILE NAME: TVI90524.RPT
TAPE COUNT: 00:26:55
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
EAST OF MH 07
PIPE DEPTH:N/A

ENDING LOCATION:
EAST OF MH 08
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 134.0 Metres	ENDING MANHOLE
08		09

FLOW DIRECTION ---->

Summary Comments

THE PIPE APPEARS TO BE IN GOOD CONDITION

Distance At	To	Inspection Comments
0.0		Starting manhole - 08
21.5		Service connection - 2 O'clock
103.9		Service protruding greater than 1" - 1 O'clock
134.0		Ending manhole - 09
134.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 17

DATE: Feb 5 1999
TIME: 12:02:36

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 450mm
FLOW DIR: S/W

REF. AREA:
FILE NAME: TVI90525.RPT
TAPE COUNT: 00:33:25
PIPE TYPE: STORM/CONC
CAMERA DIR: Against Flow

STARTING LOCATION:
S OF THE SAV. REST. S/S OF ROAD
PIPE DEPTH:N/A

ENDING LOCATION:
N/E OF MH 10
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 29.3 Metres	ENDING MANHOLE
10		11

FLOW DIRECTION <----

Summary Comments

THE CAMERA WAS BLOCKED BY HEAVY GRAVEL.
REVERSE SETUP WAS NOT REQUESTED.

Distance At	To	Inspection Comments
0.0		Starting manhole - 10
1.5	9.8	Light debris in line - Invert
4.2		Service connection - 2 O'clock
9.8	29.3	Moderate debris in line - Invert
27.8		Service connection - 2 O'clock
28.7		Service connection - 9 O'clock
29.3	29.3	Heavy debris in line - Invert
29.3		Camera blocked in line
29.3		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 17

DATE: Feb 5 1999
TIME: 12:14:58

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 450mm
FLOW DIR: West

REF. AREA:
FILE NAME: TVI90526.RPT
TAPE COUNT: 00:38:05
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
S OF THE SAV. REST. S/S OF ROAD
PIPE DEPTH:N/A

ENDING LOCATION:
WEST OF MH 10
PIPE DEPTH:N/A

CAMERA DIRECTION ----->

STARTING MANHOLE	TOTAL: 50.0 Metres	ENDING MANHOLE
10		12

FLOW DIRECTION ----->

Summary Comments

THE CAMERA WAS BLOCKED BY DEBRIS.

Distance At	To	Inspection Comments
0.0		Starting manhole - 10
23.3	50.0	Light ponding in line
27.9	50.0	Light debris in line - Invert
50.0		Camera blocked in line
50.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 18

DATE: Feb 5 1999
TIME: 13:20:43

INSP. BY:	F.H.
DISK No:	02FH
TAPE No:	02FH
PIPE SIZE:	525mm
FLOW DIR:	South
REF. AREA:	
FILE NAME:	TVI90527.RPT
TAPE COUNT:	00:43:10
PIPE TYPE:	STORM/CONC
CAMERA DIR:	Against Flow

STARTING LOCATION:
S/E CORNER OF THE ELEPHANT HOUSE
PIPE DEPTH:3.6m

ENDING LOCATION:
S/E OF AFRICAN PAVILLION
PIPE DEPTH:N/A

CAMERA DIRECTION ---->

STARTING MANHOLE	TOTAL: 42.5 Metres	ENDING MANHOLE
13		14

FLOW DIRECTION <----

Summary Comments

THE PIPE APPEARS TO BE IN GOOD CONDITION

Distance At	To	Inspection Comments
0.0		Starting manhole - 13
23.2		Service connection - 9 O'clock
26.7		Service connection - 11 O'clock
42.5		Ending manhole - 14
42.5		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 18

DATE: Feb 5 1999
TIME: 13:29:01

INSP. BY: P.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 525mm
FLOW DIR: South

REF. AREA:
FILE NAME: TVI90528.RPT
TAPE COUNT: 00:46:10
PIPE TYPE: STORM/CONC
CAMERA DIR: Against Flow

STARTING LOCATION:
S/E OF THE AFRICAN PAV.
PIPE DEPTH:N/A

ENDING LOCATION:
EAST ENTERANCE AFRICAN PAV.
PIPE DEPTH:N/A

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
14	TOTAL: 20.2 Metres	15
	FLOW DIRECTION <----	

Distance At	To	Inspection Comments
0.0		Starting manhole - 14
18.0		Service connection - 2 O'clock
20.2		Service protruding greater than 1" - 9 O'clock
20.2		Camera blocked in line
20.2		End of inspection

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 18

DATE: Feb 5 1999
TIME: 13:36:11

INSP. BY:	F.H.
DISK No:	02FH
TAPE No:	02FH
PIPE SIZE:	525mm
FLOW DIR:	East
REF. AREA:	
FILE NAME:	TVI90529.RPT
TAPE COUNT:	00:48:20
PIPE TYPE:	STORM/CONC
CAMERA DIR:	Against Flow

STARTING LOCATION:
S/E CORNER OF THE ELEPHANT HOUSE
PIPE DEPTH:3.6m

ENDING LOCATION:
S/W CORNER OF THE AFRICAN PAV.
PIPE DEPTH:N/A

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
13	TOTAL: ------.- Metres	16
	FLOW DIRECTION <----	

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 18

DATE: Feb 5 1999
TIME: 13:38:34

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 525mm
FLOW DIR: East

REF. AREA:
FILE NAME: TVI90530.RPT
TAPE COUNT: 00:48:20
PIPE TYPE: STORM/CONC
CAMERA DIR: Against Flow

STARTING LOCATION:
S/E CORNER OF THE ELEPHANT HOUSE
PIPE DEPTH:3.6m

ENDING LOCATION:
S/W CORNER OF THE AFRICAN PAV.
PIPE DEPTH:N/A

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
13	TOTAL: 31.2 Metres	16
	FLOW DIRECTION <----	

Summary Comments

THE CAMERA WAS BLOCKED BY DEBRIS.REVERSE SETUP IS REQUESTED.UNABLE TO GIVE THE SURFACE LENGTH,THERE ARE BUILDING IN BETWEEN THE MH'S

Distance At	To	Inspection Comments
0.0		Starting manhole - 13
1.5	31.2	Moderate debris in line - Invert
31.2		Camera blocked in line
31.2		End of inspection

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 18

DATE: Feb 5 1999
TIME: 13:52:21

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 450mm
FLOW DIR: East

REF. AREA:
FILE NAME: TVI90531.RPT
TAPE COUNT: 00:52:50
PIPE TYPE: STORM/PVC
CAMERA DIR: With Flow

STARTING LOCATION:
S/W CORNER OF THE AFRICAN PAV.
PIPE DEPTH:N/A

ENDING LOCATION:
S/W CORNER OF THE ELEPHANT HOUSE
PIPE DEPTH:3.6m

CAMERA DIRECTION ----->

STARTING MANHOLE	TOTAL: 51.5 Metres	ENDING MANHOLE
16		13

FLOW DIRECTION ----->

Summary Comments

THE PIPE SIZE IS 450mm.THE PIPE MATERIAL IS PVC.DEBRIS IN THE LINE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 16
2.2	51.5	Moderate ponding in line
4.7	51.5	Moderate debris in line - Invert
51.5		Extra manhole not shown
51.5		End of inspection

Report generated by Envista Ltd. V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA 18

DATE: Feb 5 1999
TIME: 14:03:13

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 525mm
FLOW DIR: South

REF. AREA:
FILE NAME: TVI90532.RPT
TAPE COUNT: 00:55:35
PIPE TYPE: STORM/CONC
CAMERA DIR: Against Flow

STARTING LOCATION:
S/W CORNER OF THE AFRICAN PAV.
PIPE DEPTH:N/A

ENDING LOCATION:
1ST MH N OF MH 16
PIPE DEPTH:N/A

CAMERA DIRECTION ——>

STARTING MANHOLE	TOTAL: 20.5 Metres	ENDING MANHOLE
16		17

FLOW DIRECTION <——

Summary Comments

THE CAMERA WAS BLOCKED BY DEBRIS.REVERSE SETUP WAS NOT REQUESTED.

Distance At	To	Inspection Comments
0.0		Starting manhole — 16
2.0	20.5	Moderate debris in line — Invert
20.5		Camera blocked in line
20.5		End of inspection

[redacted]

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA ?

DATE: Feb 5 1999
TIME: 14:38:38

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 250mm
FLOW DIR: West

REF. AREA:
FILE NAME: TVI90533.RPT
TAPE COUNT: 00:57:20
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
1ST MH W OF THE CAMEL PEN
PIPE DEPTH:2.1m

ENDING LOCATION:
2ND MH W OF THE CAMEL PEN
PIPE DEPTH:N/A

CAMERA DIRECTION ----->

STARTING MANHOLE	TOTAL: 11.0 Metres	ENDING MANHOLE
19		19

FLOW DIRECTION ----->

Summary Comments

DEBRIS IN THE LINE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 19
0.0	11.0	Moderate debris in line - Invert
11.0		Ending manhole - 19
11.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA ?

DATE: Feb 5 1999
TIME: 14:45:04

INSP. BY: F.H.
DISK No: 02FH
TAPE No: 02FH
PIPE SIZE: 300mm
FLOW DIR: West

REF. AREA:
FILE NAME: TVI90534.RPT
TAPE COUNT: 00:59:00
PIPE TYPE: STORM/CONC
CAMERA DIR: With Flow

STARTING LOCATION:
2ND MH W OF THE CAMEL PEN
PIPE DEPTH:N/A

ENDING LOCATION:
3RD MH W OF THE CAMEL PEN
PIPE DEPTH:N/A

CAMERA DIRECTION ----->

STARTING MANHOLE	TOTAL: 46.5 Metres	ENDING MANHOLE
19		20

FLOW DIRECTION ----->

Summary Comments

THE PIPE APPEARS TO BE IN GOOD CONDITION

Inspection Comments

Distance At	To	
0.0		Starting manhole - 19
1.1		Service connection - 9 O'clock
46.5		Ending manhole - 20
46.5		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO.
STREET: AREA ?

DATE: Feb 5 1999
TIME: 14:49:40

INSP. BY: F.H.	REF. AREA:
DISK No: 02FH	FILE NAME: TVI90535.RPT
TAPE No: 02FH	TAPE COUNT: 01:02:10
PIPE SIZE: 375mm	PIPE TYPE: STORM/CONC
FLOW DIR: West	CAMERA DIR: With Flow

STARTING LOCATION:
3RD MH W OF THE CAMEL PEN

ENDING LOCATION:
4TH MH W OF THE CAMEL PEN

PIPE DEPTH:N/A

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
20	TOTAL: 55.0 Metres	21
	FLOW DIRECTION ---->	

Summary Comments

THE MAP IS WRONG SUPOSSED TO MEET WITH MH 08.NOT THE CASE.

Distance At	To	Inspection Comments
0.0		Starting manhole - 20
5.2		Service connection - 2 O'clock
9.5		Service connection - 9 O'clock
23.8		Service connection - 10 O'clock
31.8	55.0	Light ponding in line
38.0		Service connection - Crown
38.0	38.0	Moderate calcite in line - Around pipe
55.0		Ending manhole - 21
55.0		End of inspection

Report generated by Ratech Data Tech V Sewer TV Inspection System

Trans-Video Inspection Ltd.
SEWER TV. INSPECTION REPORT

CLIENT: METRO TORONTO ZOO. DATE: Feb 5 1999
STREET: AREA ? TIME: 14:57:35

INSP. BY: F.H.	REF. AREA:
DISK No: 02FH	FILE NAME: TVI90536.RPT
TAPE No: 02FH	TAPE COUNT: 01:07:35
PIPE SIZE: 375mm	PIPE TYPE: STORM/CONC
FLOW DIR: West	CAMERA DIR: With Flow

STARTING LOCATION:	ENDING LOCATION:
4TD MH W OF THE CAMEL PEN	5TH MH W OF THE CAMEL PEN

STARTING MANHOLE	CAMERA DIRECTION ---->	ENDING MANHOLE
21	TOTAL: 0.0 Metres	08
	FLOW DIRECTION ---->	

Summary Comments

THE CAMERA WAS UNABLE TO MAKE THE BEND
IN THE MH.

Distance At	To	Inspection Comments
0.0		Starting manhole - 21
0.0		CAMERA NOT ABLE TO MAKE THE BEND
0.0		Camera blocked in line
0.0		End of inspection

APPENDIX 13

STORM SEWER TEST RESULTS (VIDEO)

APPENDIX 14

COMPONENT QUANTITY TAKE-OFFS

SITE SERVICES COMPONENTS
QUANTITY TAKE-OFF

	Totals	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Area 11	Area 12
Water													
1. Fire Hydrant	28		1	5					6	1			1
2. Gate Valves	5												1
3. Main Valve	95		3	12	3			4	20	10			7
4. Drinking Fountain	18				2				2	3			1
5. Building Valves	39			2	2			1	7	5			3
6. Man Holes	5			1					3	1			
7. Main Sprinkler Building Valve	1			1									
8. Non Freeze Hydrant	9		1					1	2	6			
9. Pumping Stations	1							1					
10. Pool Valve/Water Tap	8				6					2			3
11. Curb Stop	50		1	1					4	14			5
12. Curb Stop/Bldg. Valve	1			1	1								
13. Water Bowl	8			2					5				
14. Sprinklers	2												
15. Water Main Chamber	1												
16. Water Spray Post	1												
Gas													
1. Gas Valves	3			2									
2. Building Valve	1												
Sanitary/Storm													
1. Area Drains	4												
2. Clean Outs	5								2				
3. Catch Basins	275		2	46	15	10		2	27	17	11		23
4. Man Holes	328		2	36	24	3		12	33	35	10		25
5. Pool Drains	1												1
6. Pumping Stations	4				1				1	1			
7. Catch Basin/Man Hole	1										1		
8. Floor Drain	2								2				
Electrical													
1. Electrical Panels	3		1					1	1				
2. Hydro Outlet	7									4			
3. Light Standards	33												
4. Hydro Vault (transformer)	27		1	2				1	3	7			3
5. Transformer	49												
6. Electrical Man Holes	1												
7. Junction Boxes	14												
8. Elec. Post	2				1				1				

SITE SERVICES COMPONENTS
QUANTITY TAKE-OFF

	Area 13	Area 14	Area 15	Area 16	Area 17	Area 18	Area 19	Area 20	Area 21	Area 22	Area 23
Water											
1. Fire Hydrant	5	1				7		1			
2. Gate Valves	4										
3. Main Valve	11	2			12	10					1
4. Drinking Fountain	1	4			3	2					
5. Building Valves	5	2			7	5					
6. Man Holes											
7. Main Sprinkler Building Valve											
8. Non Freeze Hydrant						1					
9. Pumping Stations											
10. Pool Valve/Water Tap		1				2					
11. Curb Stop	5	7			4	3					
12. Curb Stop/Bldg. Valve											
13. Water Bowl											
14. Sprinklers							2				
15. Water Main Chamber											
16. Water Spray Post											
Gas											
1. Gas Valves	1										
2. Building Valve											
Sanitary/Storm											
1. Area Drains						4					
2. Clean Outs					3						
3. Catch Basins	22	27			25	30	16				2
4. Man Holes	27	13			40	48	12				8
5. Pool Drains											
6. Pumping Stations											
7. Catch Basin/Man Hole											
8. Floor Drain											
Electrical											
1. Electrical Panels											
2. Hydro Outlet		3									
3. Light Standards		14					19				
4. Hydro Vault (transformer)	2				3	5					
5. Transformer											
6. Electrical Man Holes							1				
7. Junction Boxes		7					7				
8. Elec. Post											

SITE SERVICES COMPONENTS
QUANTITY TAKE-OFF

	Area 24	Area 25
Water		
1. Fire Hydrant		
2. Gate Valves		
3. Main Valve		
4. Drinking Fountain		
5. Building Valves		
6. Man Holes		
7. Main Sprinkler Building Valve		
8. Non Freeze Hydrant		
9. Pumping Stations		
10. Pool Valve/Water Tap		
11. Curb Stop		
12. Curb Stop/Bldg. Valve		
13. Water Bowl		
14. Sprinklers		
15. Water Main Chamber	1	
16. Water Spray Post		
Gas		
1. Gas Valves		
2. Building Valve		
Sanitary/Storm		
1. Area Drains		
2. Clean Outs		
3. Catch Basins		
4. Man Holes		
5. Pool Drains		
6. Pumping Stations		
7. Catch Basin/Man Hole		
8. Floor Drain		
Electrical		
1. Electrical Panels		
2. Hydro Outlet		
3. Light Standards		
4. Hydro Vault (transformer)		
5. Transformer		
6. Electrical Man Holes		
7. Junction Boxes		
8. Elec. Post		

APPENDIX 15

CITY OF SCARBOROUGH FIRE PROTECTION WATER SERVICES POILCY

Thomas L. Powell, Fire Chief
Guidelines for Water Services for Fire Protection
February 26, 1992

E) Minimum size of water supply:

1. A single private hydrant only -
   6" (150mm);
2. A single private hydrant and sprinklers and/or standpipes -
   8" (200mm) to the hydrant or to the sprinklers/standpipe, 6" (150mm) to the rest. Alternatively hydraulic calculations proving the required water supply.
3. Two private hydrants -
   8" (200mm). Alternatively hydraulic calculations proving the required water supply.
4. More than two private hydrants -
   8" (200mm). Looped system required. (N.B. Main size may be reduced if hydraulic calculations are submitted proving the required water supply.)

Note: Scarborough Public Utilities Commission requirements for domestic water supply taken within building from same water service as the fire protection systems:

1. A 1" domestic supply may be taken from a 6" (150mm) service;
2. A 2" domestic supply may be taken from an 8" (200mm) service;
3. Alternatively hydraulic calculations proving the required water supply for both the fire protection system(s) and the domestic system.

5 PUC -

James C. Macdon
Director
Fire Prevention D

412 - 4526

JCM/vs

LOUIS MAGNUND
292-1530 EXT. 2012

File #SP130992.J

MARIO ZAMMIT 412-4527

RANDALL LAFRANCE 412-4537

APPENDIX 16

CORRESPONDENCE FROM ENBRIDGE CONSUMERS GAS

500 Consumers Road,
Toronto ON M2J 1P8
Tel 416 495-5489
Fax 416 495-6189
Email brian.black@cgc.enbridge.com

ENBRIDGE
Consumers Gas

fax

File Number:

To: Earnes Onyido	From: Brian Black
Organization: Paradigm Engineering Group	No. of pages (including this cover): 1
Department:	Date: 1999-05-21
Fax: Recipient 416-335-1449	If this transmission is not received in good order, please call: Sender 416-495-5489

Re: Metro Toronto Zoo – Natural Gas Supply and Piping

As I had verbally informed you, The pipe on the property of the Metro Toronto Zoo is owned by the Zoo and does not fall under the jurisdiction of Enbridge Consumers Gas. This means that Enbridge Consumers Gas is only able to provide information regarding the gas that is supplied to the system on the Zoo property.

Concerning the present load which is utilized by the zoo under peak hour conditions as supplied by Enbridge Consumers Gas is 1050 M^3 / Hr at a maximum of 45 psi. This pressure could be boosted to deliver 60 psi to the zoo system. The maximum supply that could be provided using present equipment would be 3000 m^3/ Hr. This increase however may be limited by the downstream Zoo piping system. An evaluation should be made by the Metro Toronto Zoo to establish whether any increase in capacity delivered by Enbridge Consumers Gas will be acceptable for the zoo's piping system.

As I mentioned previously, there has been no corrosion survey performed on the Zoo's system in approximately the last 12 years. A leak survey however, is completed annually and was completed three weeks ago for 1999. The results of the leak survey identified no leak indications. It is recommended that a corrosion survey be completed by the Metro Toronto Zoo the secure the integrity of the system and identify any upgrades required in the cathodic protection of the plant.

Please contact me if you have any further questions.

Brian Black

APPENDIX 17

CORRESPONDENCE FROM GRAIG ROSE OF MARSHALL MACKLIN MONAGHAN CONSULTING ENGINEERS

18-93081
memo to file
metro toronto zoo

I spoke with Andy Empringham from Scarborough Fire Prevention on Feb. 14 1995. He said that he sent a copy of my Jan. 19 submission to his fire inspector at the City of Scarborough (Steve Doran). He said that they see our design as an improvement to the existing system and will not require the existing mains to be upgraded. He said that he has the final say on this issue and that there was no need for him to provide a letter to me.

Craig Rose

18-93081-03-SU1

Post-it™ Fax Note 7671E | Date MAY 19/99 | # of pages ▸ 2

To ERNEST ONYIDO	From CRAIG ROSE
Co./Dept	Cc. MMM
Phone #	Phone #
Fax # 416 3351449	Fax #

APPENDIX 18

FIRE PROTECTION WATER SUPPLY GUIDELINE FOR PART 3 IN THE ONTARIO BUILDING CODE

DRAFT

Office of the Fire Marshal

OFM-TG-07-98

FIRE PROTECTION WATER SUPPLY GUIDELINE FOR PART 3 IN THE ONTARIO BUILDING CODE

O

F

M

TECHNICAL GUIDELINE

October 1998

TABLE OF CONTENTS

ABSTRACT

This guideline will assist those trying to establish an adequate fire protection-water supply for new and renovated Part 3 buildings as required by Article 3.2.5.7. or Part 11 of the Ontario Building Code. The criteria for "adequate water supply" will be detailed and the limitations of this criteria explained. Several other factors will be explained as they relate to the fire protection water supply, such as the fire department, environmental impact and cost.

The guideline provides a method of simple calculation of an on-site water supply, taking into account building occupancy, size, construction and exposure, as well as minimum water duration requirements. Other issues that may effect the need for an on-site water supply or design factors are discussed as well. Sample problems are included to assist the user.

INTRODUCTION

The Office of the Fire Marshal, in cooperation with the Ministry of Municipal Affairs and Housing and the Water Supply Adequacy Committee has developed this guideline to help building owners, consultants and others involved in life safety design of buildings, meet the requirements for **"adequate water supply for fire fighting"** as found in Part 3 of the Ontario Building Code (OBC). This guideline is not intended for farm buildings or buildings that fall within Part 9 of the OBC.

This guideline has been developed in conjunction with the A-3.2.5.7. Appendix Note on Adequate Water Supply in the 1997 Ontario Building Code.

The *primary purpose* of this guideline is to provide an adequate fire protection water supply to support evacuation and fire department search and rescue operations during a fire, and prevent fire spread to other buildings.

The *secondary purpose* of this guideline is to provide a fire protection water supply that can be used to provide a good measure of property protection during the early stages of a fire.

With the exception of sprinklered buildings, this guideline does not intend to provide the optimum for property protection. However with a timely response by a well trained fire department, the water supply designated in this guideline should be sufficient to allow the fire department to extinguish building fires where adverse circumstances are not encountered.

It should be noted that where "property protection" is a primary expectation of the building owner, or where significant environmental contamination from a fire is a concern, other recognized fire protection guidelines should be referenced (such as the Fire Underwriters Survey) to ensure adequate water supplies for manual fire suppression by available fire fighting means, or the building should be sprinklered. **Building owners should be made aware of the limitations of the fire protection water supply as required in this guideline, prior to the design and construction of their building and/or the design of an on-site water supply.**

It should be noted that other guidelines, such as the Fire Underwriters Survey, should be used when designing water supply systems for newly developed municipal areas, as this fire protection water supply guideline is not intended to address domestic service water needs.

OVERVIEW OF THE BUILDING CODE REQUIREMENTS

Article 3.2.5.7. of the Ontario Building Code (OBC) 1997 states: "an adequate water supply for fire fighting shall be provided for every building".

Q1 What does this mean for unsprinklered buildings?

As interpreted in this guideline, an adequate fire protection water supply for unsprinklered buildings means an immediately available and accessible water supply, with sufficient volume and/or flow to enable the fire department to use their fire hoses to control fire growth until the building is safely evacuated and search and rescue operations have been complete, and to prevent the fire from spreading to adjacent buildings. This water supply should also be sufficient to provide a limited measure of both property protection and protection against fire growth in buildings with contents that could result in a significant environmental impact.

Q2 What does this mean for sprinklered buildings?

For sprinklered buildings, an adequate fire protection water supply means a reliable water supply providing sufficient water flow for the sprinkler systems in terms of pressure, volume, and duration to limit fire growth until the fire department arrives to suppress the fire. This automatic protection is expected to provide time for the evacuation of buildings, assist the fire department in preventing fire spread to adjacent buildings, limit the environmental impact of fires, and provide significant property protection.

Note: A properly designed sprinkler system, and especially those using modern technology sprinkler heads, will often extinguish a fire even without additional manual fire fighting intervention.

FIRE DEPARTMENT RESPONSE

Q1 How does fire department response influence water supply requirements?

Determining an adequate water supply for manual fire protection is not dependent solely on building characteristics. A major factor will be the response time and intervention provided by the local fire department. This guideline assumes a prompt response by a well equipped fire department using modern fire fighting techniques, and assumes that buildings will be evacuated in accordance with established building fire safety plans and fire department pre-fire plans. Where there is no fire department see Q3 in the Special Cases Section.

An immediately available fire protection water supply permits the fire department, at their discretion, to enter a burning building with hose lines to conduct search and rescue operations. The duration of this water supply should, as a minimum, be sufficient to allow complete search and rescue throughout buildings. Once the search and rescue operations are complete, additional water may be required for exposure protection or for fire suppression to limit property damage. Exposure protection and fire suppression to limit property damage go beyond the minimum for life safety as established by water supply requirements set out in this guideline.

The fire department has discretion as to how they will use hose streams on any given fire. Where a limited amount of fire protection water is available on site, decisions will be made on how much water will be used in the initial "search and rescue" stage, the suppression stage and for exposure protection. The Fire Chief may deem it most beneficial to concentrate all fire department resources to suppress a fire in its early growth stage, thereby drawing-down the limited water supply quickly, or may instead "nurse" the limited water supply until the search

and rescue procedure is completed and then concentrate on exposure protection until supplemental water supplies arrive.

Fire departments serving remote or rural areas often have to respond to a fire with a transportable water supply having a duration of approximately five to ten minutes when using one or two 38 mm hose lines. This provides minimal hose streams allowing immediate search and rescue and fire suppression in small buildings with simple layouts. However, where a fire has had a significant head start, this transported water supply is unlikely to be sufficient to save the building.

For larger, more complex buildings, an on-site fire protection water supply is needed to provide an extended duration of hose stream use by the fire department to allow search and rescue of the building, exposure protection and fire suppression. The volume of this on-site fire protection water supply is dependent on the building size, construction, occupancy, exposure and environmental impact potential, and shall be sufficient to allow at least 30-minutes of fire department hose stream use.

COST IMPACT

Q1 How significant a cost impact will it be to provide an adequate fire water supply?

Cost impact on buildings constructed in rural or remote areas will typically be more than for buildings constructed within areas provided with municipal water mains. The great majority of existing municipal water systems will be able to satisfy the requirements of this guideline for new building construction. This would not preclude situations where new large "high fire demand" type buildings are being proposed in areas where the municipal water supply is not adequate. In these cases the building owner may need to provide supplemental fire protection water to meet the requirements of this guideline. The building owner may alternatively make design modifications to his building to reduce the water supply requirements. These modifications could include providing firewalls, using noncombustible construction in lieu of combustible construction, sprinklering the building, reducing the amount of window openings exposing a property line, etc.

Buildings constructed in rural or remote areas without a municipal water supply or an adjacent accessible body of water (i.e. river or large pond) may require on-site water storage tanks or a water reservoir for the fire protection water supply required by this guideline. Hydrants, suction connections for fire department "drafting", or underground dry mains may also be needed to provide appropriate building coverage. (See Q7 in the Special Cases Section)

SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACT

Q1 What types of building fires could result in a significant adverse environmental impact and thus require additional fire protection water supplies?

Any building used for the storage or processing of chemicals or materials should be deemed to have the potential for significant adverse environmental impact, if a fully developed fire would result in significant contamination of ground or surface water through direct runoff or atmospheric dispersion.

Q2 What fire protection criteria should be used for these buildings?

Properly designed sprinkler protection should be provided in these buildings to prevent fully developed fires. Sprinklered buildings typically require reduced amounts of water for control or suppression of a fire, thus reducing the potential for environmental impact from contaminated water run-off.

Where sprinkler protection is not provided, other recognized fire protection guidelines (e.g. Fire Underwriters Survey) may instead be used to determine the manual fire fighting water supply needs for these buildings. The Chief Building Official or Fire Official should evaluate these special cases on an individual basis.

Q3 Why do unsprinklered buildings with occupancies that constitute an adverse environmental impact typically require an increased water supply for manual fire fighting?

An increased water supply gives the fire department the option of conducting an all out fire hose suppression attack in the early stages of a fire. A successful hose deluge attack at this time may result in extinguishment before significant amounts of environmentally hazardous chemicals and materials are involved.
Note: Unsprinklered buildings will require careful preplanning by fire departments to ensure judicious application of this greater amount of fire fighting water to prevent significant adverse environmental impact due to water run-off.

WATER SUPPLY REQUIREMENTS

Q1 How do I determine water supply requirements?

To simplify this guide, requirements have been placed into four categories. It is best to use a process of elimination to determine the correct category of water supply requirements. This guideline is not intended to be used for farm buildings or Part 9 buildings. (see Q8 in the Special Cases Section)

The four categories are:

- buildings not requiring on-site fire protection water supply
- sprinklered buildings
- buildings requiring on-site fire protection water supply
- additions to existing buildings

1. Buildings Not Requiring On-Site Fire Protection Water Supply

(a) A building would not require an on-site water supply for fire fighting if the building satisfies the criteria set out in Item 1(b) or Item 1(c), provided that:

(i) the building is serviced by a municipal water supply system that satisfies Item 3(b), or

(ii) the fire department can respond with a transportable water supply of sufficient quantity to allow them to conduct an effective search and rescue of the building, determined on the basis of other guidelines or standards (such as NFPA 1231, "Standard on Water Supplies for Suburban and Rural Fire Fighting"). (also see Q1 to Q3 in the Special Cases Section)

(b) A building does not require an on-site water supply for fire fighting where all the following criteria are met

(ii) the building height is 2 stories or less,
(iii) the building does not have a Group B occupancy (care or detention),
(iv) the building does not require a sprinkler system or a standpipe and hose system,
(v) the limiting distance from the property line is at least 13 metres if the building has an F-1 occupancy (high hazard industrial), and
(vi) the building constitutes no significant environmental contamination potential under fire conditions.

(c) A building that exceeds 200 m^2 in building area or 2 storeys in building height may not require an on-site water supply for fire fighting where it has an F-3 occupancy with an insignificant combustible loading (such as found in cement plants, steel stock storage sheds, etc.), as determined by the Chief Building Official.

2. Sprinklered Buildings

For sprinklered buildings, NFPA 13, "Standard for the Installation of Sprinkler Systems", as referenced by Article 3.2.5.13. of the Ontario Building Code, shall be used to obtain sprinkler and hosestream water requirements. (see Q1 of the Further Explanation of Guideline Requirements Section)

3. Buildings Requiring On-Site Fire Protection Water Supply

(a) Except for sprinklered buildings and as required by Items 3(c) and 3(d), new buildings shall be provided with a supply of water available for fire fighting purposes not less than the quantity derived from the following formula:

$$Q = KVS_{Tot}$$

where
Q = minimum supply of water in litres
K = water supply coefficient from Table 1
V = total building volume in cubic metres
S_{Tot} = total of spatial coefficient values from property line exposures on all sides, as obtained from the formula:

$$S_{Tot} = 1.0 + [(S_{Side1}) + (S_{Side2}) + (S_{Side3}) + \text{... etc.}]$$

where S_{Side} values are obtained from Figure 1, as modified by Items 3(e) and (f), and
S_{Tot} need not exceed 2.0

(see Explaining the Calculations Section)

(b) Except as provided in Item 3(d), water supply flow rates shall not be less than that specified in Table 2. Where the water supply is from a municipal or industrial water supply system then the required flow rate shall be available at a minimum pressure of 140 kPa

(c) Except as provided in Item 3(d), the minimum fire protection water supply (Q) required in Item 3(a) shall not be less than what is needed to provide the minimum flow rate specified in Table 2 for a duration of **30 minutes**.

(d) In elementary and secondary schools, the water supply determined in accordance with Items 3(a) and 3(b) may be reduced. The level of reduction to be applied would be at the discretion of the local jurisdictional authority, and should not exceed 30%. Factors to consider should include fire department response time, fire department resources and the size and complexity of the school building. (see Q10 of the Special Cases Section)

(e) Where a masonry wall with a minimum fire-resistance rating of 2 hr. and no unprotected openings is provided as an exterior wall, the spatial coefficient (S_{side}) for this side of the new building may be considered equal to 0. This exterior masonry wall shall be provided with a minimum 150 mm parapet.

Firewalls that divide a structure into two or more buildings may be given similar consideration when evaluating the exposure of the buildings to each other.

(f) The spatial coefficient (S_{side}) may be considered equal to 0 when the exposed building is on the same property and is less than $10m^2$ in building area.

4. Additions to Existing Buildings

(a) Except as permitted in Items 4(b) and (c), additions to existing buildings shall be provided with a fire protection water supply as required in Items 3(a) to 3(f). (See Q2 in the Further Explanation of Guideline Requirements Section)

(b) Buildings with new additions falling into any one of the following criteria would not require an additional water supply for fire fighting where:

(i) the expanded building complies with all the requirements of Item 1(a),

(ii) the new addition does not exceed $100m^2$ in building area, or

(iii) the new addition exceeds $100m^2$ but does not exceed $400m^2$ in building area, contains an assembly, business and personal services, mercantile or low hazard industrial occupancy, is of noncombustible construction, does not result in a significant increase in exposure to other existing buildings, has no combustible storage or process, and is separated from the existing building by a minimum 1 hour fire-rated separation.

(c) Where a firewall is provided between the new addition and the existing building, the fire protection water supply may be determined in accordance with Items 1(a) and 3(a), using only the building volume of the new addition.

Note: Consideration should be given to designing the water supply to the more stringent requirements of the two separated buildings.

TABLE 1
WATER SUPPLY COEFFICIENT – K

TYPE OF CONSTRUCTION	Classification by Group or Division in Accordance with Table 3.1.2.1 of the Ontario Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC, including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. of the OBC. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC, including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

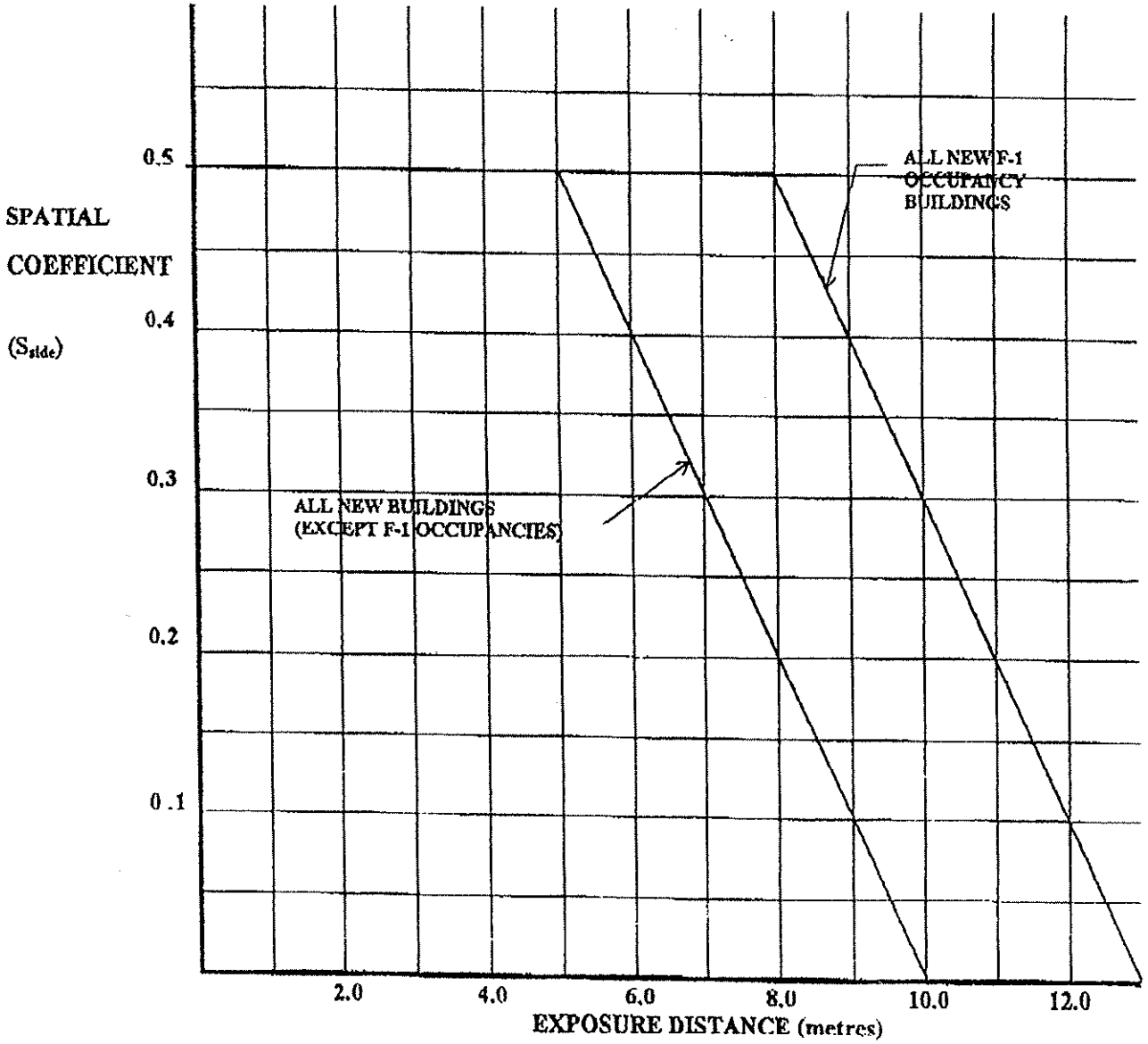
TABLE 2
MINIMUM WATER SUPPLY FLOW RATES

OBC Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/Min.)
One-storey building with building area not exceeding 600m² (excluding F-1 occupancies)	1800
All other buildings	2700 (If Q ≤ 108,000L)[1] 3600 (If Q > 108,000L and ≤ 135,000L)[1] 4500 (If Q > 135,000L and ≤ 162,000L)[1] 5400 (If Q > 162,000L and ≤ 190,000L)[1] 6300 (If Q > 190,000L and ≤ 270,000L)[1] 9000 (If Q > 270,000L)[1]

Note [1] $Q=KVS_{tot}$ as referenced in Item 3(3)

FIGURE 1

SPATIAL COEFFICIENT VS EXPOSURE DISTANCE



EXPLAINING THE CALCULATIONS

Q1 What is the "K" factor and how were these values developed?

The K factor, also known as water supply coefficient, is a value that takes into account typical compartmentalization of buildings, combustibility of construction, combustible loading of the building occupancy and evacuation responses by the building occupants.

These factors were developed using the "occupancy hazard classification numbers" and "construction classification numbers" in NFPA 1231, adjusting them to fall within the occupancy classifications of buildings within the Ontario Building Code, and then modifying them so that the final units of the equation are in litres. Table 1 of this guideline lists K values according to type of construction and occupancy classification.

Q2 What volume is included in "V"?

All spaces below and above grade within a building, measured to the underside of the roof deck, should be included in the volume (cubic metres) for the fire protection water supply formula. An exception may be made to exclude a non-combustible crawl space (with no combustible services) below a non-combustible floor, located under the lowest building floor area, if it will not be developed in the future or used as a storage area.

Q3 How are "exposures" measured?

Exposure distances from a new building will be measured from the exterior building faces to the property lines of that building. The distance from the face of the building to the property line shall be determined as per OBC 3.2.3.1.(3). When facing a street, the property line shall be deemed to be the centre of the street.

When facing an existing building (exceeding 10 m² in building area) on the same property, the exposure distance (for use in Figure 1) shall be the greater of either the "limiting distance" of the new building face as obtained in OBC 3.2.3.1.(1), or the mid-point between the two buildings.

Q4 How are spatial coefficient values obtained from Figure 1?

Once the exposure distance for each building face has been determined, these values can be located along the horizontal arm at the bottom of Figure 1. By following straight up from these points the graph line may be intersected providing a spatial coefficient value (S_{side}) along the left vertical arm of Figure 1. Exposure distance values of at least 10 m. (except F-1 occupancies which require a minimum of 13.0 m) result in a spatial coefficient value of 0.

Q5 How are multiple exposures calculated?

Where a new building has exposures on more than one side, the percentage increase in the fire protection water supply due to the exposures on each side should be totaled to reflect all exposure protection requirements. [e.g. if exposure to one side results in a 50% increase in water volume (i.e. $S_{side1} = 0.50$), and exposure to another side results in a 25% increase in water volume (i.e. $S_{side2} = 0.25$), then the total increase in water volume for exposure protection is 75%. The totaled spatial coefficient (S_{tot}) is then

Q6 What is the rationale for the minimum 30 minute water supply duration and what new buildings will be most affected by this requirement?

The minimum 30 minute fire protection water supply duration requirements as stated in Item 3(b), recognizes life safety concerns by providing a dependable and immediately available fire protection water supply for the fire department's use. It is intended that the duration be long enough to allow complete search and rescue of any building by the fire department. This minimum fire protection water supply should also give the fire department a reasonable opportunity to control and/or extinguish a small fire upon their arrival, thereby preventing its growth and spread to adjacent buildings and limit any negative environmental impact. This minimum 30 minute duration requirement also allows a reasonable time for the fire department to arrange for supplementary water supplies using a water shuttle system for most buildings.

Concerns for minimum fire protection water supply volumes are mostly relevant for building sites not serviced by municipal water supply systems, where an on-site fire protection water supply has to be provided. Building sites serviced by municipal water supply systems will usually be provided with sufficient water volumes for their fire protection needs. The guideline focuses on water supply flow rates at minimum pressures for these buildings. It should be noted however that some municipalities have fairly limited water supply storage capacities and should therefore be evaluated when a new "high demand" building is to be constructed.

Q7 How do exterior 2 hr. rated masonry walls with parapets and no unprotected openings and interior firewalls influence exposure, and thus water supply calculations?

Interior firewalls and exterior masonry walls fire-rated for 2 hours, with parapets and no unprotected openings, are expected to remain in place during the period that fire exposure is greatest. Exposure to adjacent buildings is reduced to a point where additional exposure protection water may not be needed.

Judgment by the Chief Building Official should be used in determining the design of exterior 2 hour fire-rated masonry walls and interior firewalls with regard to exposures. The usual 6 inch parapet may not be considered adequate exposure protection where a new building exposes a much higher existing building in close proximity. Rather than having to increase the water supply due to exposure, a higher parapet may be sufficient protection. In situations where parapet design or other exposure protection methods do not provide adequate exposure protection for the existing building, then additional exposure fire protection water may be required.

Where firewalls divide a new facility into separate buildings, the fire protection water supply should be sized to the building with the greatest water supply demand.

Q8 What would be the impact on fire protection water supply requirements for a new building if an existing exposed property has its own on-site fire protection water supply?

Where a new building exposes an existing property provided with its own independent on-site fire protection water supply, the Chief Fire Official may deduct this water supply from the quantity needed by the new building due to this exposure. This neighbouring water supply should be accessible to the fire department to protect exposed buildings.

The Chief Fire Official should be satisfied that the two property owners will properly maintain their respective fire protection water supplies for the life of their buildings. This agreement may require approval from the municipality and may be subject to criteria provided by the Building Code Commission.

FURTHER EXPLANATION OF GUIDELINE REQUIREMENTS

Q1 Regarding sprinklered buildings, where in NFPA 13 are hose stream requirements specified?

NFPA 13 contains the hose stream requirement for sprinklered buildings in the "Occupancy Hazard Fire Control Approach" section (in Chapter 5 of 1992 to 1998 NFPA 13 edition). Within, is a table entitled "Hose Stream Demand and Water Supply Duration Requirements". This table provides total inside and outside hosestream requirements and duration for each hazard classification of sprinkler system design.

A sprinkler contractor designing a sprinkler system for a building will determine the minimum water supply requirements for the sprinkler system. Using the duration period obtained from the above referenced table, the contractor will add the sprinkler and hose stream requirements and calculate the total fire protection water supply required for the building.

Q2 Where new additions are added to existing buildings that do not have an on-site water supply, what volumes of water are considered adequate for life safety and exposure?

Whereas Part 11 of the OBC indicates that only the addition to an existing building is required to conform to OBC Part 3, this might in reality not be adequate to deal with life safety and exposure where fire protection water supply needs are concerned.

When an addition is added to an existing building and water supply calculations are based only on the volume of the addition, the fire protection water supply provided on-site might not be adequate to allow full search and rescue throughout the entire building. As well, exposure to neighbouring buildings from the new addition may not be reflective of the nature and size of a potential fire in the enlarged building. Calculations using the entire volume of an expanded building therefore are the only accurate indication of fire protection water supply needs.

Q3 Does this guideline apply to buildings that are being renovated under Part 11 of the Building Code?

Part 11 of the Building Code should be reviewed to determine the conditions under which Article 3.2.5.7. applies. This is found in the Compliance Alternative tables in Part 11.

Where Article 3.2.5.7. does apply, the existing water supply should be evaluated to determine if it is sufficient for the renovated building. Some discretion may be used by the building official if the water supply for the renovated building is not significantly greater than the existing water supply.

SPECIAL CASES

Q1 Can water transported by the fire department be satisfactory to protect small buildings?

Smaller buildings of 2 stories or less and with a building area of 200m^2 or less, may be adequately protected by a fire department using proper pre-planning methods and transported fire protection water supplies. NFPA 1231, "Standard on Water Supplies for Suburban and Rural Fire Fighting", provides methods to assist the fire department with this pre-planning. Where the fire department does not have the equipment necessary for a proper water shuttle system to adequately protect these smaller buildings as per NFPA 1231, an on-site fire protection water supply should be considered.

Q2 What extra precautions, if any, should be taken for institutional occupancies?

Buildings with Group B, Division 1, 2 and 3 occupancies should be treated in a special manner with respect to fire protection water supplies. The occupants of these buildings require direct supervisory assistance for phased evacuation during a fire. This could result in a prolonged search and rescue by the fire department. If this type of building is located in areas not serviced by municipal water mains, the fire protection water supply that the fire department is capable of transporting to the site may not be adequate for the duration of this search and rescue period. Only a properly sized on-site fire protection water supply will provide the hose stream duration that the fire department needs. Alternatively, sprinkler protection could be provided.

Q3 What provisions should be made where fire department response is slow or nonexistent?

For new buildings constructed in areas where fire department response is not expected in a reasonable time, the building should be sprinklered to help ensure safe evacuation. In locations where a fire department pumper truck is not provided, consideration should be given to installing a private water supply capable of providing a minimum 700 kPa (100 psi) water pressure at the required flow rate to permit fire fighters or other persons trained in the use of fire hoses, to effectively use a "fog-nozzle" hose spray on the fire. This type of hose spray is most effective at controlling fires. Alternatively, sprinkler protection could be provided.

Q4 How should an outdoor reservoir be designed to take into account ice formation?

When designing an open, unheated reservoir to provide a fire protection water supply as required in this guideline, a 600 mm ice depth allowance should be included in the water volume calculations. Where local winter temperature conditions result in a greater ice depth (as typically found on local lakes or ponds), this should be factored into the volume calculations.

Q5 What provisions should be made to ensure that water reservoir supplies do not drop to unsafe levels as a result of evaporation or leakage?

A make-up water supply should be provided to maintain the design volume of fire protection water supply reservoirs. Storage tanks should be provided with limit switches, pressure gauges or water-level gauges to monitor volume.

If make-up water supply for open water supply reservoirs is provided by natural refill methods (i.e water table seepage) and periods of drought are common, the reservoir capacity should be increased to take into account the reduced water table levels expected from the evaporation of water.

Q6 What standards should be used to provide an acceptable water supply design?

Tanks should conform to NFPA 22, "Water Tanks for Private Fire Protection", and the local fire department should be consulted to determine appropriate connections for their pumping equipment.

Fire main installations should conform to NFPA 24, "Private Fire Service Mains and Their Appurtenances".

On-site fire pump installations should conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps".

Sprinkler standards other than NFPA 13, "Standard for the Installation of Sprinkler Systems", such as NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes", and NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies Up To and Including Four Stories", may be used where appropriate for the type of building covered by these standards. These other standards should be acceptable to the local jurisdictional authority.

For new buildings that present a special hazard to a community as a result of their size, occupancy or economic importance, the Fire Underwriters Survey Guide should be used to determine suitable water supply and hydrant siting.

Q7 For evaluation of the fire protection water supply and associated fire hydrants, are there other considerations in addition to those set out in the OBC?

Impounded fire protection water supply for a remote building shall be accessible to the fire department to allow the use of suction lines for drafting either directly from the impounded water source, or from a dry hydrant supplied from the impounded water source. This water source or hydrant shall be located in adherence to OBC 3.2.5.7.(2).

Where at least two widely separated private fire hydrants are required to protect a building and water is to be supplied from a single on-site fire protection water supply (e.g. reservoir), it is acceptable to provide a fire department pumper connection adjacent to the water supply to allow a pumper truck to pump into an underground "dry" main feeding the two remote hydrants. This arrangement permits fire fighters to attach hoses directly to the hydrants or to use a second pumper truck to draw boosted water from these hydrants.

Existing water flow test information obtained to determine the adequacy of the municipal or private water supply for fire protection of a new building should be evaluated with regard to how dated the test information is, whether the flow test was conducted during high or low demand periods, and the possibility that future development in the area will significantly affect the supply. A current hydrant flow test at the proposed construction site will provide the most accurate information.

When dealing with new buildings serviced by municipal or industrial pressurized fire protection water systems, this guideline specifies a minimum water flow rate at 140 kPa pressure. The 140 kPa pressure is the accepted minimum that most fire departments will allow service mains to be drawn down to. Water main and/or booster pump damage could occur from cavitation at pressures below this level.

Q8 Can this guideline be used for Part 9 of the OBC?

The OBC does not currently require that Part 9 buildings be provided with an adequate water supply for fire fighting. However, this guideline may be used on a voluntary basis to provide a suitable fire protection water supply for these buildings.

The Water Supply Adequacy Committee recommends that an on-site fire protection water supply as required by this guideline be provided for multi-unit residential (Group C) type buildings (i.e. hotels, motels, apartments, townhouse complexes, etc.) that fall within Part 9 of the OBC. These buildings inherently have delayed building evacuation, resulting in more extensive search and rescue operations, and will likely benefit from an on-site fire protection water supply.

Q9 How are standpipes and hose systems affected by these requirements?

Where a building requires a standpipe and hose system per the OBC, the standpipe system should continue to be designed to Article 3.2.9.2. The standpipe will draw from the required water supply specified in this guideline, still leaving a significant fire protection water supply for exterior hose stream use.

Q10 Can the water supply requirements of this guideline be reduced in buildings with an established fire safety plan that can ensure a rapid building evacuation?

Elementary and secondary schools have a record of well established and practiced fire safety plans which allow complete school evacuations within 4 minutes. Because of this and the inherent high level of supervision in these types of facilities, a reduction of up to 30% in the fire protection water supply requirements as set out for unsprinklered buildings in this guideline may be given. However, caution should be used if the duration of water supply is reduced to less than 30 minute, unless other compensating features are also provided.

Other considerations to keep in mind should include disabled students and teachers that are being introduced into the general school population. A delayed evacuation may be expected for them. This could result in prolonged search and rescue operations by the fire department and should be considered when determining water supply reductions.

Q11 Can the water supply requirements of this guideline be reduced if alternate fire suppression methods are proposed?

Alternate fire suppression methods may result in reduced water supply requirements when compared to design parameters set out in this guideline. Questions should be directed to the local authority that has jurisdiction over these matters.

Alternative fire suppression methods being considered for allowing a reduction in the water supply requirements of this guideline are, foam/water extinguishing systems, carbon dioxide extinguishing systems or dry chemical extinguishing systems. Exterior water curtain (deluge) systems may be considered in lieu of fire protection water supply requirements for exposure purposes.

WATER SUPPLY ADEQUACY COMMITTEE

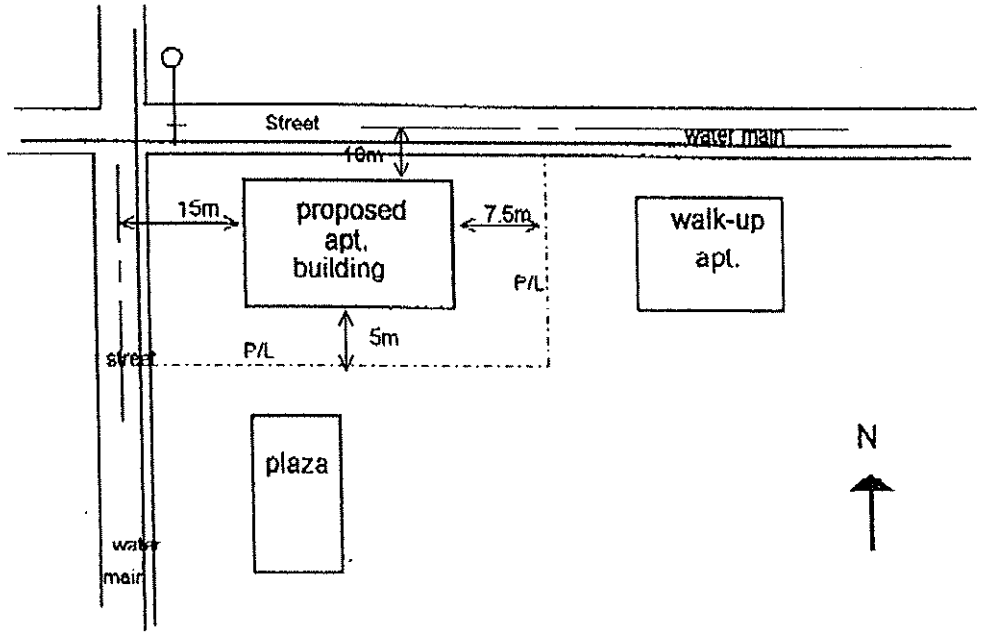
Kim Bailey - Office of the Fire Marshal
John Braun - American Water Works Association
Roy Chalk - Ontario Municipal Fire Prevention Officers Association
Steve Penna - Ontario Building Officials Association
David Shantz - Municipal Engineers Association
Tom Eyre - Ontario Municipal Water Association
Don Livingston - Ministry of Housing, Buildings Branch
Ed Coe - Insurers Advisory Organization
Chief Tom Powell - Ontario Association of Fire Chiefs

EXAMPLE PROBLEMS

PROBLEM #1

A new apartment building is to be constructed in your municipality. The building will measure 30m by 25m, with 3m between floors, and consists of 3 storeys plus a basement used for storage and laundry facilities. Parking will be outside. The building is to be of combustible construction and is to conform to 1997 OBC 3.2.2.47. An attic space is also provided in this building with a 750m^3 volume. A 30 min. fire separation is provided between the 3rd floor and the attic space. The building is not to be sprinklered nor provided with a standpipe system.

The building is located on a corner lot and faces 2 streets (see diagram). Property lines are located 5m to the south and 7.5m to the east of the proposed building. All of the buildings are serviced by municipal water mains and hydrants. What is the required minimum flow rate of the municipal main for an adequate fire protection water supply?



SOLUTION - PROBLEM #1

(1) Determine building classification

-residential apartment is Group C

(2) Check parameters of Item 1(a) to determine whether building requires an on-site water supply. *- building exceeds 200m², has two stories with significant combustibles and is not a Part 9 building, therefore needs water supply evaluation*

(3) Calculate $Q=KVS_{Tot}$

(i) determine K

- from Table 1, based on building construction and classification, the water supply coefficient K=18

(ii) calculate the building volume, $V= L \times W \times H$

- use total height of building, 3 storeys plus basement, and attic space (750m³).
(3m between floors x 4 floors =12m)
$V=$ (30m x 25m x 12m) + 750m³ = 9750m³

(iii) Determine S_{Tot} from Figure 1

- consider each side of the building:
- the north and west sides of the building each face a street and the distance to the centre of the streets exceed 10m, so S_{Side} will be equal to 0.0 on both sides.
- the property line is 5m to the south of the building. From Fig. 1, S_{Side} is equal to 0.5, meaning that a 50% increase in the volume of water will be required to protect this side.
- the property line to the east of the building is 7.5m. From Fig. 1, S_{Side} is equal to 0.25, meaning that a 25% increase in the volume of water will be required to protect this side.
-therefore, because of the exposure on the south and east sides of the building, it will be necessary to increase the total volume of the water by 75% (the sum of all the spatial coefficients from each side).

i.e. S_{Tot} = 1+ (total of spatial coefficients)
= 1+ (0.5 + 0.25)
= 1.75 (Note: S_{Tot} need not exceed 2.0)

therefore, $Q = KVS_{Tot}$
$= 18 \times 9750 \times 1.75$
$= 307,125$ litres

(4) determine the water supply flow rate

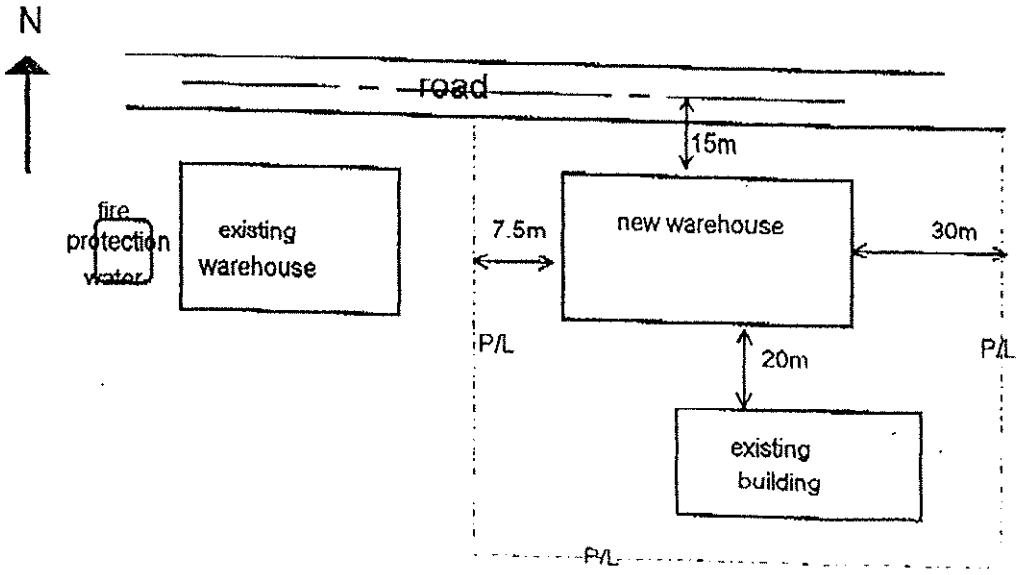
- from Table 2, since the building either exceeds 1 storey or its area is greater than 600 m², and the calculated Q is greater than 270,000 litres, the required minimum water supply flow rate from the municipal system would be 9000 L/Min.
- this flow rate is required at 140 kPa in accordance with Item 3(b).

PROBLEM #2

A single storey warehouse and distribution center, classified as a low industrial hazard occupancy, is to be built in an area not serviced by a municipal water supply. The building is to be 1500 m² in area, 4 metres high and of noncombustible construction conforming to Subsection 3.1.5. of the Ontario Building Code. This building falls within 1997 OBC 3.2.2.80. Storage commodities vary, but in general are farm implements in wood crates.

The warehouse faces one street to the north, with property lines 30m to the east and 7.5m to the west. An existing building is located on the same property and will be 20m to the south of the proposed new warehouse. The new warehouse building will have 10% unprotected openings in its south face.

There is a similar type warehouse that has its own 20,000 litre on-site fire protection water supply located to the west. This water supply is determined by the fire department to be reliable and accessible. How much water will be required on site for fire protection of the proposed building?



SOLUTION - PROBLEM #2

(1) Determine building classification

proposed low hazard warehouse building is Group F-3

(2) Check parameters of Item 1(a) to determine whether building requires an on-site water supply.

building is a Part 3 building as it exceeds 600 m² in area and has a significant combustible loading, therefore needs on-site water supply

(3) Calculate $Q=KVS_{Tot}$

(i) determine K

- from Table 1, based on building construction and classification the water supply coefficient K=19

(ii) calculate the building volume, V= Area x H

$= (1500 \times 4) = 6000\ m^3$

(iii) Determine S_{Tot} from Figure 1 by considering each side of the building:

- on the east side of the proposed building the distance to the property line exceeds 10 meters so no increase in water volume is necessary.

- the proposed building faces a street on the north side with distance to the center of the street 10 meters away. No increase in the water volume will be required due to lack of exposure on this side.

- the proposed building faces an existing building on the same property, 20m to the south. The 10% unprotected openings in the south building face of the proposed building results in a "limiting distance" of 2.5m using Table 3.2.3.1.A. of the OBC. Since the midpoint between the two buildings on the same property (10m) is greater than the limiting distance of the south face of the new building, the 10m is deemed the exposure distance. No increase in water volume will therefore be needed from exposure on this side.

- the property line to the west is 7.5 meters from the exterior wall, which means a 25% increase in the volume of water to protect the property on that side. However, the neighbour's warehouse has its own reliable 20,000 litre fire protection water supply, so this can be used to reduce the exposure needs. Exposure calculations should be completed to evaluate the neighbouring water supply, therefore,

$S_{Tot} = 1 +$ total of spatial coefficients

$= 1 + (.25) = 1.25$

and, $Q = KVS_{Tot}$

$= 19 \times 6000 \times 1.25 = 142{,}500$ litres

Of this amount, 28,500 litres (142,500 - 114,000 = 28,500) is required for exposure, of which 20,000 litres is already provided on the exposed property. Therefore an additional 8,500 litres should be added to the on-site water supply to make up the shortfall in exposure protection. Therefore, Q= 122,500 litres (114,000 + 8,500 = 122,500).

(4) determine the water supply flow rate

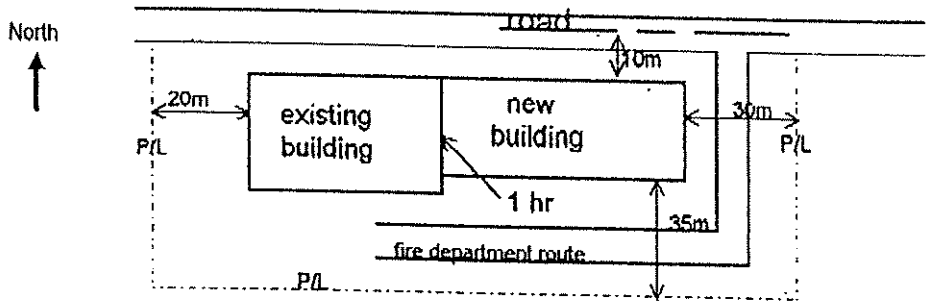
- from Table 2, since the building area exceeds 600m² and the calculated Q is greater than 108,000 litres but less than 135,000 litres, the required minimum water supply flow is 3600 L/Min. However, in accordance with Item 3(b) it must also be confirmed that 3600 L/Min. can be flowed for a minimum 30 minutes. Since a 34 min. duration is achieved (122,500 ÷ 3600 = 34 min.), this is satisfactory.

PROBLEM #3

An existing 400 m^2 single storey (with basement) school is being provided with a 400 m^2 addition of noncombustible construction. The existing building is of combustible construction with a 45 min. rated roof and basement ceiling (structural supports rated as well), while the new addition is of noncombustible construction as well and meets the requirements of 1997 OBC 3.2.2.25. Both the new and existing buildings are provided with full basements, 2.5 m. in height. The ground floor has a ceiling height of 3.0 m. An attic space is provided in both buildings, each with volume of 800 m^3. A 1 hr. fire rated separation is to be provided between the new and existing structures.

No water mains or hydrants are located in the area. A hose standpipe is voluntarily being provided throughout the entire building, with a booster pump. Distances to the property lines are as indicated on the accompanying sketch. An all volunteer fire department with limited equipment is located within 20 min. of the building site.

What size pond is needed on site (assuming no freezing temperatures), to ensure minimum life safety requirements?



SOLUTION - PROBLEM #3

(1) Determine building classification

- school building is Group A-2

(2) Go to Item 4(a) of the water supply guideline. Item 4(b)(iii) indicates that a single storey, noncombustible addition with an assembly occupancy, up to 400m² in building area, with no combustible storage or process and separated from the existing building by a minimum 1 hr. fire separation would not require additional water supplies for fire fighting purposes.

(3) The local jurisdictional authority however, may also wish to take into consideration the ability of the local fire department to provide an effective water supply shuttle system to this school by using NFPA 1231 as a guide. If equipment is not available to provide effective amounts of water supply, then an on-site water supply may be the best choice. Note that this is what Item 1(a)(ii) is alluding to.

(4) If an on-site water supply is chosen, it may be sized by calculating $Q = KVS_{Tot}$

(i) although OBC Part 11 would only size the on-site water supply to the addition, the fire department should determine if this is sufficient for their search and rescue needs.

(ii) assuming the entire building volume is selected to determine Q, determine K

- from Table 1, based on building construction and classification the water supply the existing building has a coefficient K=18 and the new addition has a coefficient K=16.

(iii) calculate the building volume, V=L x W x H

$V_{Existing} = (400 \times 3) + (400 \times 2.5) \div 800 = 3000\ m^3$

$V_{Addition} = (400 \times 3) + (400 \times 2.5) \div 800 = 3000\ m^3$

(iv) Determine S_{Tot}

- From Figure 1, since no property lines are less than 10 m away, all Ssides = 0.0, therefore no addition water volume is needed for exposures. ∴ $S_{Tot}=1.0$

$Q = KVS_{Tot}$

$= (KVS_{Tot})_{Existing} + (KVS_{Tot})_{Addition}$

$= (3000 \times 18 \times 1.0) + (3000 \times 16 \times 1.0)$

$= 102{,}000$ litres

This is the required pond size, assuming a means to maintain the water level and no freezing concerns. Note that Item 3(d) also allows a reduction in the water supply and flow rate for schools. This reduction may not be considered due to the all volunteer fire department with limited equipment.

(5) determine the water flow rate

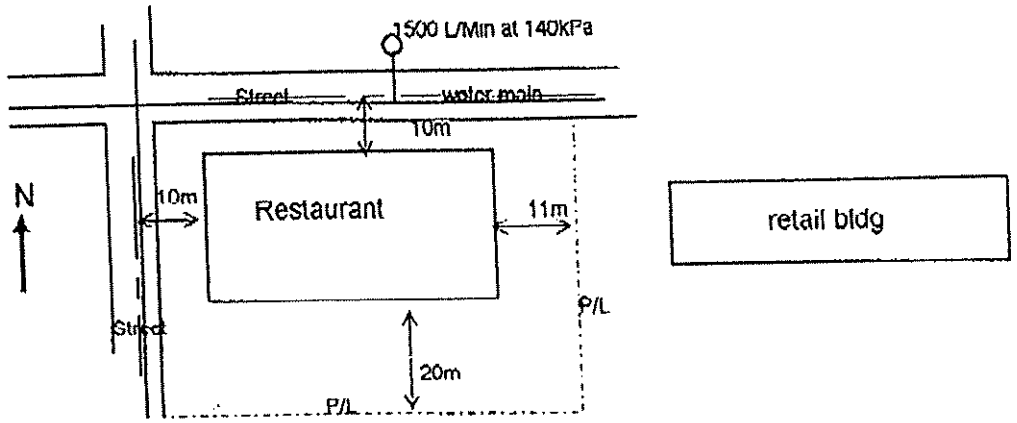
- from Table 2, since the building area exceeds 600m² and the calculated Q is less than 108,000 litres, the required minimum water supply flow is 2700 L/Min. However, in accordance with Item 3(b) it must also be confirmed that 2700 L/Min. can be flowed for a minimum 30 minutes. Since a 38 min. duration is achieved (102,000 ÷ 2700 = 38), this is satisfactory. Note if the water supply was sized to only the addition then a 54,000 litre pond, allowing a 30 minute duration at a flow rate of 1800 L/Min. would be required. However, at 2700 L/Min., which is a reasonable flow rate for the entire structure, this provides only 20 min. duration.

PROBLEM #4

A 300 m² single storey restaurant is to be constructed of noncombustible construction in a town with a marginal water supply due to old mains and poor gridding. The municipal water reservoir is sized for 1.0 million gallons. The building will have a 3.5 m. high ceiling. No hose standpipe or sprinklers are planned.. Is the existing street supply adequate?

Property lines are located 11m to the east and 20m to the south. Street centre line distances are 10m to the north and west.

The fire department routinely arrives at a fire scene in this part of town with a tanker/pumper truck carrying enough water (4500 litres) for two 38 mm hoses adequate for 5 minutes of discharge. The hydrant at the street can provide 1500 L/Min. at 140kPa.



SOLUTION - PROBLEM #4

(1) Determine building classification

-restaurant building is Group A-2 occupancy.

(2) Check parameters of Item 1(a) to determine whether building requires an on-site water supply.

-building falls within Part 3
-building area is more than 200m² and is not an F-3 occupancy.

(3) Compare existing water supply with required water supply

- as the building is ≤ 600m², the required water supply flow rate from Table 2 for this size building is 1800 L/Min.
-provided public water supply from hydrant at street is 1500 L/Min at 140kPa (adequate volume of supply)
-transported water supply by fire department is 4500 litres.
-the required water supply shortfall from public supply only is (1800 -1500)=300 L/Min. The transported water supply by the fire department will last 15 minutes if used at a flow rate of 300 L/Min (4500/300=15 min.) to make up shortfall from the public supply.

(4) Solutions to make up water supply shortfall

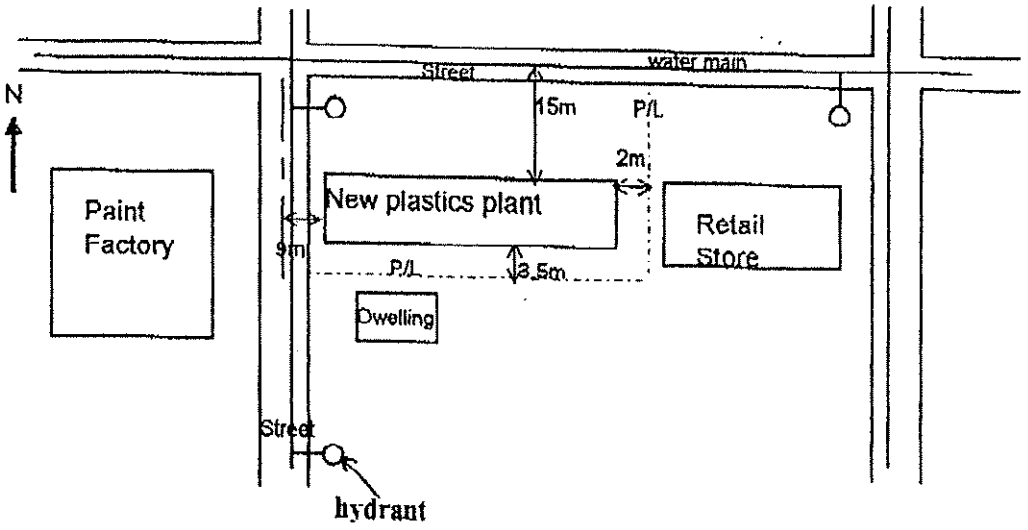
Option #1 - *as the total water supply that is deemed adequate for this new building is 1800L/Min x 30min.= 54000 litres, and the provided water supply is (1500x30)+ 4500 = 49500 litres, then require an additional on-site water supply of 4500 litres*

Option #2 - *provide an additional transportable water supply source (i.e. tanker truck) of 4500 L.*

Option #3 - *the Chief Fire or Building Official may determine that 1650 L/Min is satisfactory based on building occupancy and layout, and the restaurant's fire safety plan. The Chief Fire or Building Official may also determine that "life safety" is no longer a significant concern after 15 minutes in this type of occupancy and the remaining public water supply is satisfactory for exposure concerns.*

PROBLEM #5

A new 4 storey plastics extrusion plant (F-2 occupancy) is being constructed in a town with a marginal water supply. The flat-roofed building will cover a 500 m² area and be 12.0 m. in overall height. Construction is to be combustible and in conformance with 1997 OBC 3.2.2.70. The roof and floor separations have a fire-resistance rating of 45 min. Exposure includes property lines 2m and 3.5m away and street centre lines 9m and 15m away to the west and north. What is the required water supply from the street mains for this new building?



SOLUTION - PROBLEM #5

(1) Determine building classification

-Group F-2 occupancy

(2) Check parameters of Section (1) to determine whether building requires an on-site water supply.

-building is a Part 3 building as it meets dimensional parameters (i.e. more than 3 stories)

(3) Calculate $Q=KVS_{Tot}$

(i) determine K

- from Table 1, based on building construction and classification, the water supply coefficient K=31

(ii) calculate the building volume, $V= L \times W \times H$

$= 500 \times 12$

$= 6000m^3$

(iii) determine S_{Tot} from Figure 1(consider each side of the building) :

- the street center line to the north is more than 10m away thereby providing no exposure concerns.

- the street center line to the west is 9m away thereby resulting in an S_{Side} of 0.1

- the P/L to the east is 2m away resulting in an S_{Side} of 0.5

- the P/L to the south is 3.5m away, resulting in an S_{Side} of 0.5

- therefore the resulting total of spatial coefficient values is:

$S_{Tot} = 1 + (0.1 + 0.5 + 0.5)$

$= 1 + (1.1)$

$= 2.1$

(however as S_{Tot} need not exceed 2.0, assume $S_{Tot} = 2.0$)

(iv) therefore, $Q = KVS_{Tot}$

$= 31 \times 6000 \times 2.0$

$= 372{,}000$ *litres*

-It should be confirmed that the municipal reservoir has this reserve fire fighting water supply capacity.

(4) Determine the water supply flow rate

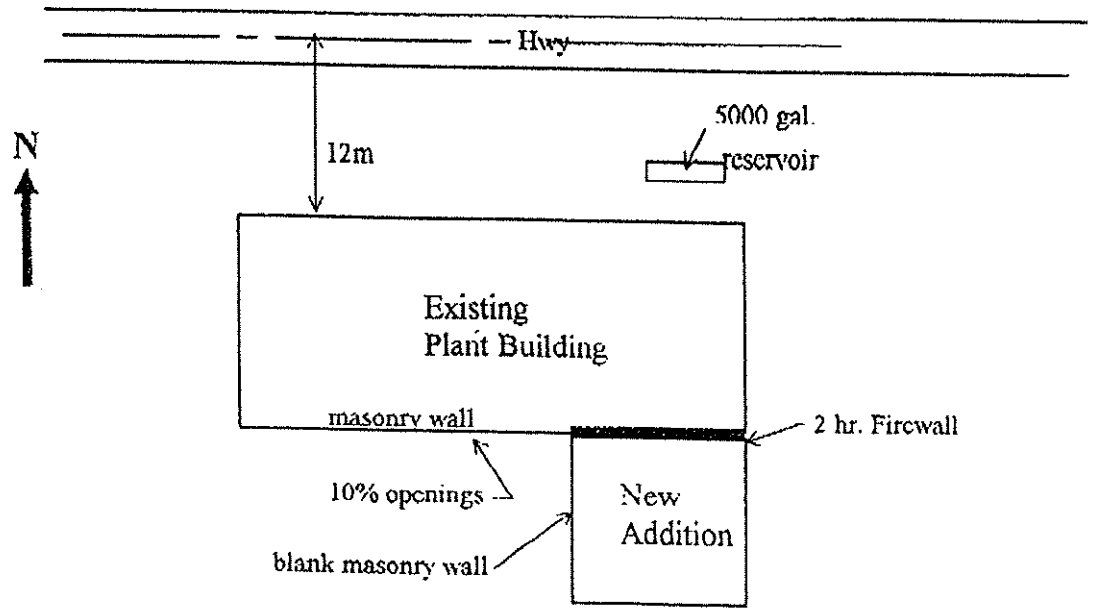
- from Table 2, this type of building requires a minimum fire protection water supply flow rate of 9000 L/Min at 140kPa. Water flow tests on street hydrants at the building site should confirm this minimum flow.

PROBLEM #6

A 200m² single storey flammable liquids storage and paint mixing room is being constructed on the southwest corner of this existing remote 600m², single storey metal parts fabricating and treating plant. The property line is no closer than 60m from the building in the south, east and west directions. The center line of the highway to the north is 12m. An existing 5000 Imp. gal. fire protection water supply is currently provided on-site, with a dry hydrant to provide fire department draft from this reservoir.

The building is located in an area surrounded by agricultural lands used for growing cash crops, and lakes used to provide potable water for the local communities.

The existing building has interior hoses but no sprinklers. The new addition is to be separated from the existing building by a 2 hr. firewall, but is not to be sprinklered. The addition is to be 4m in height and of noncombustible, non-rated construction. The walls of the addition at right-angles to the existing building are blank masonry, while the masonry walls of the existing building at right-angles to the addition has 10% openings. Is the existing water supply sufficient for the addition or the existing building.



SOLUTION - PROBLEM #6:

(1) Determine new building classification

-Group F-1 occupancy

(2) Check parameters of Section (4) for this addition. Item 4(c) deals with firewalls separating additions from existing buildings. Check parameters of Section (1) to determine whether addition requires an on-site water supply.

- the addition has an F-1 occupancy and is therefore a Part 3 building. Because the chemical occupancy of the addition may result in a significant adverse environmental potential to the local aquifer, the addition does not fall within Section 1. Therefore check Section (2) and (3).

(3) Addition is not to be sprinklered so Section (2) does not apply.

(4) From Section (3) calculate Q for the addition using $Q=KVS_{Tot}$

(i) determine K

- from Table 1, based on building construction and classification, the water supply coefficient K=37

(ii) calculate the building volume, $V= L \times W \times H$

$= 200 \times 4$

$= 800m^3$

(iii) determine S_{Tot} from Figure 1(consider each side of the building) :

- the P/L to the east, west and south exceeds 13m resulting in S_{Side} values of 0 in each direction.

- to the north the limiting distance to the south exposed wall of the existing building from the blank west wall of the addition is determined from 1997 OBC 3.2.3.1.(1). Because of the blank masonry wall the limiting distance is 0.

- therefore the resulting total of spatial coefficient values is:

$S_{Tot}= 1+ (0 + 0 + 0 + 0)$

$= 1.0$

(iv) therefore, $Q= KVS_{Tot}$

$= 37 \times 800 \times 1.0$

$= 29,600$ litres

(4) Determine the water supply flow rate

- from Table 2, F-1 occupancy buildings require a minimum fire protection water supply flow rate of 2,700 L/Min. The existing on-site fire protection water supply of 5,000 Imp. gal. (22,750 litres) can provide this flow rate for 8 minutes.

- Since a minimum 30 minute duration in water supply is needed, an additional 58,250 litres of on-site water supply is needed for the addition to make up the shortfall (81,000-22,750).

- The existing building may also be evaluated to see if water supply requirements would be higher. Owner may decide to provide additional water demand if higher.

Note: Under the OBC the existing building also has to be evaluated to determine the

APPENDIX 19

BLACK & McDONALD – HIGH VOLTAGE MAINTENANCE REPORTS DATED AUGUST 1999, REFERENCE NO. 6621

Black & McDonald

Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

August 16, 1999

Toronto Zoo
361A Old Finch Ave.
Scarborough, Ontario
M1B 5K7

ATTENTION: **Mr. Dean Evans, Electrical Supervisor**

Subject: **1999 High Voltage Maintenance**

Our Reference #: **6621**

Dear Sir:

During June this year, we completed the ***Preventive Maintenance Program*** on the high voltage power apparatus located at your site. This work was carried out to the specifications outlined in tender proposal #48 (98-10).

The following sections are included in the report:

- **Deficiencies and recommendations**
- **Inspection Sheets**

Intent

The intent of this program was to evaluate and report on the condition of the high and low voltage equipment in your main and unit substations. This evaluation would detect any problems in their early stages, indicating potential problems in your system that would eventually lead to equipment failure.

Black & McDonald

Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

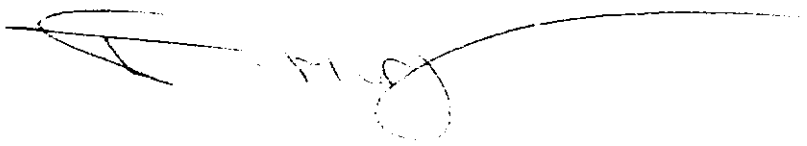
Findings

The problem areas together with detailed recommendations can be found in section "A". Detailed information pertaining to any of the deficiencies listed in this section can be reviewed with the individual test sheets compiled in section "B". In-order to avoid any unexpected downtime we would recommend taking the necessary corrective measures listed in section "A".

Should you require any further assistance or information, please do not hesitate to contact our office at your convenience. We thank you for the opportunity to have been of service.

Yours sincerely,

BLACK & McDONALD LIMITED



R.P. (Rodger) Morgan

Technical Field Service Division

Black & McDonald

Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

"A" DEFICIENCIES & RECOMMENDATIONS

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Deficiencies and Recommendations

Main Incoming Switchgear

1.) Main Feeder "DIP" Pole

Deficiency:

The main fuses on this pole were found to be out of co-ordination with the downstream switchgear fuses. Both were sized at an amperage of 150E. Due to the subsequent interruptions caused by cable failures, these have been replaced and the pole-mounted fuses re-sized to 200E.

Recommendation:

Review sizing and speed (TCC #) requirements with the supply authority. Ensure stock of these S&C SMU-20 style fuse units for future ready availability.

2.) Main 27.6kV Incoming Switch

Deficiency:

The Blue/ Cϕ arcing interrupter was found to be defective.

Recommendation:

Replace this S&C interrupter unit.

3.) Feed to Eurasia Pavilion

Deficiency:

The B & C phase interrupters on this switch measure over the readable scale in both positions. They are defective.

Recommendation:

Replace these two arcing interrupters.

4.) All Fused Switch Cells

Deficiency:

Due to the power cable failures and the resulting numerous fuse operations, the spare fuse stock in these feeder cells has been significantly depleted.

Recommendation:

Restock the spare fuse inventory.

North America Pavilion

5.) Loop Feed to Service Building

Deficiency:

Flash marks were observed on both the left phase barrier and beside the associated lightning arrestor.

Recommendation:

Replace the phase barrier and touch up cell as required.

6.) Paddock Feeders

Deficiency:

Only one spare fuse link is available in the switch/ fuse compartment.

Recommendation:

Restock the spare fuse inventory.

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Entrance/ Administration Building

7.) Feeder to Village Edge South

Deficiency:

Only one spare fuse link is available in the switch/ fuse compartment.

Recommendation:

Restock the spare fuse inventory.

Africa Pavilion

8.) Paddock Feeder

Deficiency:

No spare fuse links are present in this feeder cell.

Recommendation:

Restock the spare fuse inventory.

9.) Main Secondary Breaker

Deficiency:

This FPE 75H-2 (s/n. TH-4126-72) 3000 Amp circuit breaker was found to be mechanically problematic. The breaker failed to consistently trip even though the trip bar was fully engaged. The unit was extensively investigated during the maintenance shutdown and repaired to serviceable condition. ***Note that this field repair should only be considered as a temporary fix!***

Recommendation:

Because of the nature of the discovered defects, this unit will require thorough stripping and rebuilding/ service. This will require the removal of the circuit breaker from service and may necessitate the installation of temporary generator power as per your needs.

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10.) MCC1 Circuit Breaker

Note:

Due to the time and personnel involved in investigating of the main circuit breaker, the other smaller breaker designated as "MCC1" was not tested. This unit has been previously reported as problematic and may also need additional servicing.

Indo-Malaya Pavilion

11.) Feeder to Entrance Facilities

Deficiency:

The Bϕ cable terminator in this switch cell was found with a top porcelain skirt broken.

Recommendation:

The damaged area was sealed with contact cement. No further action is required at the present time.

12.) Indo-Malaya Paddock Feeder

Deficiency:

The arc interrupter operator (attached to the switchblade) was found to be broken. As a result the interrupter now does not function.

Recommendation:

To restore the interrupter's functionality, the entire Load Interrupter switchblade arm will have to be replaced.

13.) Indo-Malaya Paddock Feeder

Deficiency:

No spare fuse links are present in this cell.

Recommendation:

Restock the spare fuse inventory.

14.) Main Secondary & DP MB Circuit Breakers

Deficiency:

- The front flash barrier is missing on the "Main …" C.B.
- The front flash barriers are cracked on the "DP MB" C.B.
- "DP MB" mechanism was found to be sticking.

Recommendation:

- The "DP MB" mechanism was restored to proper operation. No further action is required.
- Replace the flash barriers on both circuit breakers.

Eurasia Pavilion

15.) Paddock Feeders (Centre & South)

Deficiency:

The Kirk RE12023 interlock is inoperable due to the switch handle being bent out of position. The switch is still operational.

Recommendation:

If full functionality is desired, then the switch handle must be replaced. If this is not a priority, then the switch is presently functional and requires no further action.

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16.) Paddock Feeders (Centre & South)

Deficiency:

Only one spare fuse link is available in the switch/ fuse compartment.

Recommendation:

Restock the spare fuse inventory.

17.) Eurasia Pavilion Transformer T-1

Deficiency:

The top skirt of the H3 primary bushing was found to be cracked.

Bushing Spec.: Westinghouse T1; DWG. No. 25kV400A; S.O. 544C638G05

Recommendation:

The crack was sealed with epoxy. No further action is required at the present time. ***The condition of this bushing should be monitored during subsequent shutdowns.*** Subsequent deterioration will require bushing replacement in this Askarel (PCB)-filled equipment.

Submersible & Pad-Mount Transformers

18.) Submersible Transformers (General)

Note:

The majority of the approximately 50 units on site are more than 25 years old. These units are approaching the end of their operational service lives. While no one can accurately predict the exact moment of failure for each unit, recent events have shown that they may fail at any time.

A graduated replacement program should be considered by engineering and procurement staff so as to modernise the existing transformer inventory, and prevent unnecessary downtime caused by failures.

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19.) Submersible Transformers Oil Levels

Deficiency:

Several of the submersible transformers were observed with the oil level below the manufacturer's recommended fill line. This is likely as a result of there only being a small quantity of oil in the units and them having been sampled on previous occasions.

Recommendation:

Purchase a barrel of Voltesso 35 electrical grade insulating oil (or equivalent) to be used to top up the units as needed during future shutdowns. This barrel should be stored in an area where it will be sheltered from elements (moisture, etc.) that can degrade its properties.

20.) Submersible Vault #1 (Fed from Service Building)

Deficiency:

The "H1B" elbow on this unit (s/n. 871935) was found with burn marks on it.

Recommendation:

The elbow and transformer bushing insert should be replaced in the near future

21.) Submersible Vault #32 (Fed from N. America)

Deficiency:

The manhole gasket on this Red Phase transformer (s/n. 861949) is in poor condition. Improper sealing of the unit can allow the entrance of moisture and degradation of the oil.

Recommendation:

Replace this access cover gasket.

22.) Interfacial Tension (IFT) Levels

Deficiency:

Interfacial tension is a measure of the barrier between the oil and water. A lowering of this level is an indication that oil is beginning to degrade.

A number of the transformers had borderline IFT levels. The worst of these is the Vault #18 unit (s/n. LO721-1), which has a measured level of 18.2 dynes/ cm; the N.E.T.A. standard recommended minimum is 32 dynes/ cm.

Recommendation:

The Vault #18 transformer should be sampled again within 6 months both to confirm the initial reading and trend for deterioration.

23.) Weston Station

Note:

This unit substation was reported to be in poor condition. The station should be shutdown during daylight hours for a thorough evaluation.

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"B" INSPECTION SHEETS

Black & McDonald

Technical Field Service Division
31 Pullman Court Scarborough, Ontario. M1X 1E4 Phone: (416) 298-9977 Fax: (416) 298-2907

METROPOLITAN TORONTO ZOO
Infrared Inspection Report

Prepared For: Dean Evans
Date: July 27, 1999

Prepared By: Kevin Josephs
Our Reference: 6621

Black & McDonald

Technical Field Service Division

31 Pullman Court Scarborough, Ontario. M1X 1E4 Phone: (416) 298-9977 Fax: (416) 298-2907

July 27,1999

Metropolitan Toronto Zoo

361A Old Finch Avenue

Scarborough, Ontario

M1B 5K7

ATTENTION: Mr. Dean Evans

Subject: *Infrared Inspection Report*

Our Reference: *6621*

Dear Sir:

We have completed your infrared inspection on June 9, 1999. There is list of the areas scanned in this report as well as our findings and recommendations for your review and comment.

Within the report you will find an Infrared Survey Sheet that displays a Thermogram window, below that image there is a **'Profile'** window. This window measures the object's temperature along that line in the form of a line graph.

The deficiencies found during the inspection do not warrant any quotation for parts.

We advise that in our opinion the electrical power apparatus as covered in the report, having been inspected, tested and not yet repaired. Sub-stations located in the Indo & Austraialasia Pavilion appears to be in good condition except what's noted f in the applicable section of this report.

If any questions arise regarding these matters, please feel free to contact the undersigned at any time.

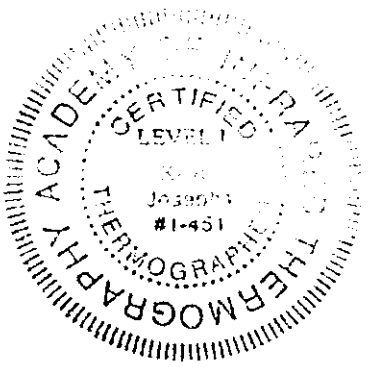
Sincerely,

BLACK & McDONALD LIMITED

K. (Kevin) Josephs

Senior Infrared Technologist

Technical Field Service Division



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Purpose:

The purpose of an infrared inspection is to detect heat. Heating is normal in an electrical system since it is caused by the flow of current through a conductor. Therefore, the heat we are searching for is heat, which is abnormal. Unusual heating conditions are caused by several phenomena such as:

- Poor Connections Due To:
  - Looseness
  - Dirt
  - Oxidation
  - Over loading
- Other Conditions Producing Heat Are:
  - Load Imbalances
  - Harmonics

Survey Intent:

It is the intent of this survey to act as a predictive tool in order to detect unforeseen problems in the specified areas of your electrical distribution system. Further, our report will satisfy all requests by your insurance company with respect to the completion of an infrared scanning program.

Background:

Every body emits infrared heat radiation because of its temperature. Infrared Thermovision systems detect the energy and convert it into a visual picture. Infrared radiation is a direct and proportional function of the body temperature and, by utilizing a special feature (Isotherm) on the infrared System, the temperature differentials can be accurately determined.

The isotherm will appear on a visual image as a series of bright green dots, which have a correspondence to a specific temperature reading.

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Applications:

Infrared technology is used industry wide as a preventive maintenance tool. All major power consumers use this type of survey on a regular basis. The cost savings associated with the reduction of preventive maintenance man-hours have proved time and time again to justify the cost of the original survey.

Results:

The results are presented in the form of a video print out of the thermal image as seen by the infrared system operator. A corresponding real life picture of the area in question is also supplied. This allows for easier location of the hot spot, as sometimes it is difficult for the untrained eye to perceive detail from the thermograph.

Technical data relative to the suspect area is also provided. This includes the exact identity of the suspect area and/ or device and/ or component, the load currents, our comments as to the suspected cause and our recommendations pertaining to corrective action.

If the electrical system is operating at 60% of its rated capacity then the following rule of thumb may be used to determine the severity of the condition.

Temperature Rise	Classification
1 - 10 Degrees Celsius	Minor Problem. Repair At Your Convenience
10 - 35 Degrees Celsius	Intermediate Problem. Repair In The Next Three Months
+35 Degrees Celsius	Serious Problem. Make Repairs Immediately

Corrective Action:

Infrared technology is one of the truly predictive maintenance tools available today. However, it is only as useful as the corrective action taken to remedy problems, which are discovered.

Therefore, when infrared scanning is carried out it should be done during a period of time when the operation of the facility is as high as possible. It should also be carried out in conjunction with and prior to substation maintenance inspections.

In this way detected problem areas can be corrected with a minimum amount of disruption to the normal operation of the facility.

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Areas Scanned

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Indo Pavilion

- *Main Electrical Room*
- *Old Orang Holding*
- *New Orang Holding*
- *Lighting Panel(s) Around Exhibit Area*
- *Gaur Building #1 & #2*
- *MCC Board* ***(Booster Switch & Fan #16 Door Didn't Open)***

African Pavilion

- *Main Electrical Room*
- *Lighting Panel(s) Around Exhibit Area*

America's Pavilion Building

- *Pump Room*
- *Electrical Room*
- *Fan Room*
- *Exhibit Area*

Australasia

- *Main Electrical Room*
- *Boiler Room*
- *Panel(S) Around the Exhibit Area*

Education & Main Gift Shop

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Entrance Facilities

(Front Office Room Locked)

Animal Hospital Building

North Service Building

- *Main Floor*
- *Shop Area*
- *Basement*
- *3rd Floor*
- *Main Electrical Room*

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Inspection Results and Recommendations

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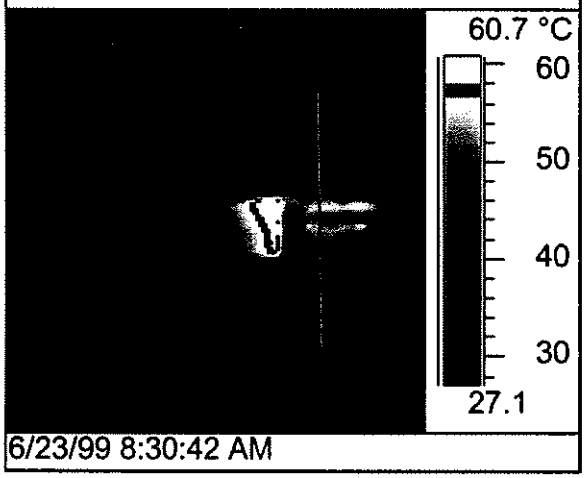
Infrared Survey Sheet

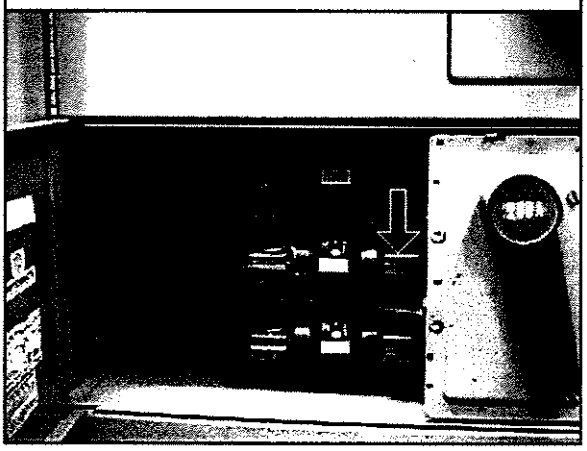
Job No.:	**6621**
Customer:	**Metropolitan Toronto Zoo**
Site Location:	**Toronto, Ontario**
Equipment I.D.:	**F.P.E. 200A 120/208V Disconnect (Auto Transfer Sw.)**
Equipment Location:	**Indo Pavilion Main Electrical Room**
Inspection Date:	**5/2/89 1:18:15 AM**

IR - I0000100.031



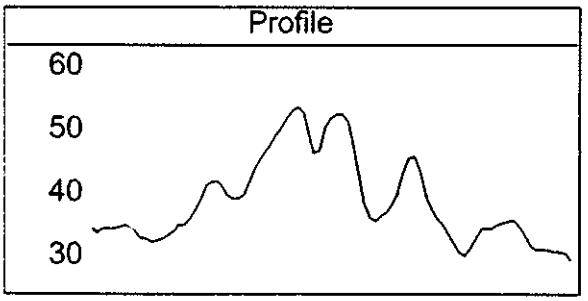
6/23/99 8:30:42 AM

Photo - IMAGE18.BMP



Surface Profile Minimum Temperature:	**29.7 °C**
Isotherm Area Temperature:	**58.0 °C**
Surface Profile Maximum Temperature:	**54.0 °C**

Profile



Status

SCANNER DATA	
Scanner Type	THV470 SWB
Serial Number	73010
Level	415
Sens	5
Aperture	0
Filter	NOF
Lens	20
IMAGE OBJ. PAR.	
Emissivity	0.84
Amb. temp.	23.7 °C
Atm. temp.	24.8 °C
Object dist.	1.0 m
Rel Humidity	0.50
Transmission	0.99

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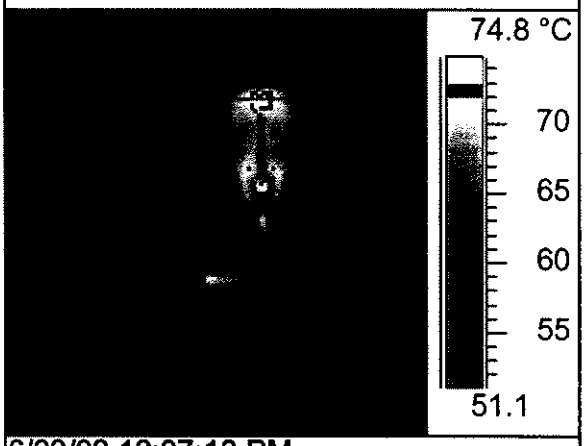
Infrared Survey Sheet

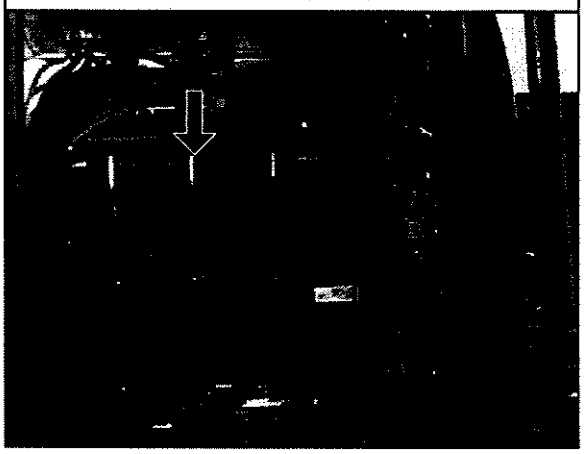
Job No.:	**6621**
Customer:	**Metropolitan Toronto Zoo**
Site Location:	**Toronto, Ontario**
Equipment I.D.:	**Square 'D' 60A Starter Fan #5 General Supply-EU1001**
Equipment Location:	**Austrialasia Pavilion**
Inspection Date:	**5/2/89 5:37:40 AM**

IR - I0000100.032



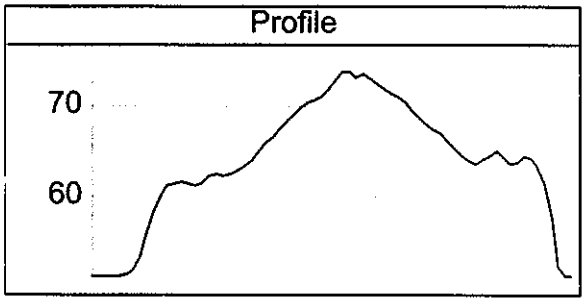
6/23/99 12:07:13 PM

Photo - IMAGE19.BMP



Surface Profile Minimum Temperature:	**<51.1 °C**
Isotherm Area Temperature:	**72.9 °C**
Surface Profile Maximum Temperature:	**73.9 °C**

Profile



Status

SCANNER DATA	
Scanner Type	THV470 SWB
Serial Number	73010
Level	584
Sens	5
Aperture	0
Filter	NOF
Lens	20
IMAGE OBJ. PAR.	
Emissivity	0.81
Amb. temp.	22.9 °C
Atm. temp.	25.2 °C
Object dist.	1.0 m
Rel Humidity	0.50
Transmission	0.99

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Inspection Recommendations

NB. Please refer to individual infrared inspection sheets by the designation given in the PHOTO window

1. F.P.E. 200A 120/208V Disconnect (Auto Transfer Switch) Main Electrical Room (Indo Pavilion)

Description: *The Centre phase line end fuse clip area recorded a maximum thermal rise of 54.0 ℃, thus creating a temperature rise of 30.3 ℃ above ambient. The load taken at that time was Top $\phi \cong 55$ Amps, Centre $\phi \cong 70$ Amps, and the Bottom $\phi \cong 42$ Amps.*

Required Action: *Checking this area for proper connection and removing any oxidized agents is necessary to correct the anomaly.*

2. Square 'D' 60A Starter (Fan #5 General Supply – EU1001 Austrialasia Pavilion

Description: *The Centre phase blade contact area recorded a maximum thermal rise of 73.9 ℃, thus creating a temperature rise of 51.0 ℃ above ambient. All three phases were balanced at 40 Amps.*

Required Action: *This area needs to disassembled, cleaned and checked for proper connection.*

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Main Incoming
Outdoor 27.6kV Switchgear

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	RPM/KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Main Outdoor Incoming		
Substation	Pole-mounted Supply Fuse		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	25	**kVolt**
Type	SMU-20 Fuse Unit	**Current**		**Amps**
Style/Cat #		**Serial #**		

Fuse Link Nameplate Data			
Type	SMU-20 Fuse Unit	**TCC**	119-2
Style/Cat #		**Amps**	150 E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	N/A	
Support Structure Condition	OK	
Spare Fuses	?	None seen. Provided by Toronto Hydro

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	458	644	496			
Results Satisfactory	These units have subsequently been replaced.					

T.S.

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	RPM/KH/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Main Outdoor Incoming		
Substation	Main 27.6 kV		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34163	**Serial #**	---	

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	POOR	Blue O Defective
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK/ Fair	Some internal rust damage

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	50.5	28	12.3			
Contact Resistance (μΩ)	56	63	55			
Arc Interrupter Res.(Ω)	0.6	0.7	High			
Results Satisfactory	Fair – See Recommendations					

T.S.

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	KH/ TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feed to Eurasia Pavilion		
Substation	Main Outdoor 27.6 kV		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti Interrupter	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**	---	

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	Kirk # RE 12045
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	Cleaned
Moving Contact Surfaces	OK	Cleaned
Arcing Contact Surfaces	OK	Cleaned
Contact Alignment	OK	
Arcing Interrupter	POOR	High Resistance in Closed Position
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	51	53	57			
Arc Interrupter Res.(Ω)	1.3	*	*			
Results Satisfactory	See Recommendations					

T.S.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	KH/ TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Eurasia Pavilion		
Substation	Main Outdoor 27.6 kV		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	153-4
Style/Cat #	134250R4	**Amps**	150E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	Fair	2 spares in cell during inspection

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	630	828	636			

Results Satisfactory	See Recommendations

T.S.

T.S. HV_Fuse

Black & McDonald

TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	RPM/KH/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Service Building		
Substation	Main Outdoor 27.6 kV Incoming		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	Kirk RE 12043
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	Cleaned
Moving Contact Surfaces	OK	Cleaned
Arcing Contact Surfaces	OK	Cleaned
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	49	42	47			
Arc Interrupter Res.(Ω)	1.3	1.0	0.5			

Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	RPM/KH/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Service Building		
Substation	Main Outdoor 27.6kV Incoming		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5D	**Current**	300	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	153-4
Style/Cat #	134250R4	**Amps**	150E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	Poor	One only during inspection

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	688	627	623			
Results Satisfactory	Spares Required.					

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

North America Pavilion

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Loop Feeder to African Pavilion		
Substation	North American Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063R2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	90	82	92			
Arc Interrupter Res.(Ω)	0.4	0.4	0.4			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Loop Feed to Service Building		
Substation	North American Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data				
Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063R2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	Fair Poor	Flash Marks Present on Barrier, etc.
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	90	81	80			
Arc Interrupter Res.(Ω)	0.4	0.3	0.5			
Results Satisfactory	*See Recommendations*					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeders		
Substation	North American Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data				
Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	Kirk RE12053
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	Fair	Surfaces pitted
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	92	112	153	272	280	300
Contact Resistance (μΩ)	79	82	77			
Arc Interrupter Res.(Ω)	0.4	0.4	0.3			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeders		
Substation	North American Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	27.6	**kVolt**
Type	SM-5	**Current**	300E	**Amps**
Style/Cat #		**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	119-4
Style/Cat #	264125-R4	**Amps**	80E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	Fair	One Spare Present in Cell

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	1005	1100	1060			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	American Pavilion Trans. #5		
Substation	North American Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	37	37	40			
Arc Interrupter Res.(Ω)						
Results Satisfactory	OK					

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Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM/ TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	North American Pavilion Trans. #5		
Substation	North American Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolt**
Type	SM-5	**Current**	300	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134025R4	**Amps**	15E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	3 Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	6190	6260	6050			
Results Satisfactory	OK					

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Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T5		
Substation	North American Pavilion		

Power Transformer -Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	Y-Y	
Type	LNAN		**Serial #.**	827695	
Neutral	Solid		**Liquid Type/Vol**	Askarel 200	**Gal**
Rating	300/ 336	**kVA**	**Total Weight**	7020	**lbs.**
Impedance	5.4	**%**	**Primary Voltage**	27.6/ 16	**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	208/ 120	**Volt**
Frequency	60	**Hz**	**BIL**	150/ 45	**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 1k VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	31.6	31.0	
Corrected to 20 °C.			

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)		280		9154	
Corr. 20 °C					
Dis. Fact.(%)		5.70		6.56	
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X1 H0-H1**	**X0-X2 H0-H2**	**X0-X3 H0-H3**
1					
2					
3	27,600	0.754	0.746	0.746	0.746
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 14, 1999
File Number	6621	**Sampled By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T5		
Substation	North American Pavilion		

Oil Analysis

Transformer Data

Manufacturer	Westinghouse	**Primary Volts**	27.6/ 16	**kVolts**
Type	LNAN	**Rating**	300/ 336	**kVA**
Serial No.	827695	**Liquid Volume**	200	**Gals.**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
				1999
Dielectric Breakdown	D877	30 kV		46.7
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.008
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)		1.520
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)				
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB fluid
Dissolved Gas Content	---

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM/ JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T5		
Substation	North American Pavilion		

Power Transformer -Mechanical

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Breather & Silica Gel	N/A	
Explosion Vent Gaskets	N/A	
Pressure Relief Device	OK	
Conservator Tank Gaskets	N/A	
Inspection Cover Gaskets	OK	
Main Cover Gaskets	N/A	
Primary Bushing Gaskets	OK	
Primary Bushing Porcelain	OK	
Primary Bushing Connections	OK	
Secondary Bushing Gaskets	OK	
Secondary Bushing Porcelain	OK	
Secondary Bushing Connections	OK	
Secondary Throat Gaskets	OK	
Radiator	OK	
Pressure Gauge	OK	
Gas Relay	N/A	
Oil Level	OK	
Oil Leaks	OK	
Tank Valves	OK	
Oil Temperature Gauge	OK	
Oil Temperature Run/Max	35 | 40°c	
Winding Temperature Gauge	N/A	
Winding Temperature Run/Max		
Tap Changer		Unit Locked: Inoperable
Paint Condition	OK	
Pad	OK	
Grounding	OK	
Fan Operation	N/A	
Control Wiring	N/A	
Results Satisfactory	**OK**	

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T5 Secondary		
Substation	North American Pavilion		

Bus Duct

Nameplate Data

Manufacturer	Square D	**Voltage**	600	**Volts**
Type	I-Line	**Current**	1000	**Amps**
Style	3 Phase, 4 Wire	**B.I.L.**		**kVolts**
Cat #	AF-510-23-FES	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Bus Insulation	OK	
Type of Bus Insulation	OK	
Support Insulators	OK	
Interior Clean	OK	Visible Sections Only
Interior Dry	OK	Visible Sections Only
Bus Duct Enclosure	OK	
Bus Duct Enclosure Ventilated	N/A	
Bus Joints Clean & Dry	OK	
Bus Joints Torqued	OK	
Gaskets at Joints	OK	
Grounding	OK	
Enclosure Paint Condition	OK	
Support Structure	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*N*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	1120	1260	900	---	2520	2320	2200

Comments	
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	North American Pavilion		

Low Voltage Air Circuit Breaker

Nameplate Data

Manufacturer	ITE	**Voltage**	600	**Volts**
Type	K1600	**Frame Rating**	1600	**Amps**
Serial #	98012	**Int. Rating**	65	**kAmps**
Relay Type	OD4 Dashpots Only	**Sensors Ratio**		**Amps**
Rating Plug.		**Limiter Rating**	N/A	**Amps**

Relay Calibration Results

	Settings		ϕA		ϕB		ϕC	
	P/U	**T.D**	**P/U**	**T.D.**	**P/U**	**T.D.**	**P/U**	**T.D.**
Long Time	1000A	Inst.						
Short Time								
Instantaneous								
			P/U	**T.D.**				
Ground Fault								

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	OK	
Bus & Grounding Stabs	OK	
Interlocks	OK	Rack Out Only
Manual Operation	OK	
Electrical Operation	N/A	

Electrical Tests

Test Description	ϕA	ϕB	ϕC	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	25	31	27			
Results Satisfactory	OK					

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Technical Field Service Department

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Africa Pavilion

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Indo-Malaya Pavilion		
Substation	Africa Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	780	540	755	3420	3280	4080
Contact Resistance (μΩ)	55	57	65			
Arc Interrupter Res.(Ω)	0.7	0.5	0.9			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to North America Pavilion		
Substation	Africa Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	780	540	755	3420	3280	4080
Contact Resistance (μΩ)	38	36	36			
Arc Interrupter Res.(Ω)	0.7	1.4	0.8			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Africa Paddock Feeder		
Substation	Africa Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	SM Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	780	540	755	3420	3280	4080
Contact Resistance (μΩ)	50	50	48			
Arc Interrupter Res.(Ω)	0.6	0.5	0.5			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeders		
Substation	Africa Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	27.6	**kVolt**
Type	SM-5	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	
Style/Cat #		**Amps**	

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	POOR	No Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	1030	960	1030			
Results Satisfactory	Fair. Spares Required.					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH/ RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	McDonald Savannah (Africa Paddock Fed)		

Pad-Mounted Distribution Transformer

Transformer Nameplate Data

Manufacturer	Cam Tran		**Year Built**	1997		
Type	ONAN		**Serial #**	97DC231201		
Neutral	Solid		**Liquid Type/Vol**	Oil	1436	**Litres**
Rating	500	**kVA**	**Total Weight**	3492		**Kg**
Impedance	5.4	**%**	**Primary Voltage**	27.6/ 16		**KVolt**
Phase(s)	3	**ϕ**	**Secondary Voltage**	208/ 120		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)	>505,000					

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	44.4
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.027
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	40.1
Specific Gravity	**D1298**	**0.84 - 0.91**	0.867
Colour	**D1500**	**≤3.5 Max.**	<0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Padmount to Africa Sub. 3 phases; to T10 3 phases		

Pad-Mounted Distribution Transformer

Transformer Nameplate Data

Manufacturer	CARTE		**Year Built**	1996	
Type	ONAN		**Serial #**	2B301-001	
Neutral	Solid		**Liquid Type/Vol**	Oil 1023	**Litres**
Rating	225	**kVA**	**Total Weight**	2227	**Lbs.**
Impedance	4.34	**%**	**Primary Voltage**	27.6/ 16	**kVolt**
Phase(s)	3	**ϕ**	**Secondary Voltage**	208/ 120	**Volt**
Frequency	60	**Hz**	**BIL**	125	**kVolt**
Insulation Resistance (MΩ)	435,000				

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	32.0
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.013
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	38.6
Specific Gravity	**D1298**	**0.84 - 0.91**	0.889
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	African Pavilion Trans. T-6		
Substation	African Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	SM Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	780	540	755	3420	3280	4080
Contact Resistance (μΩ)	38	36	36			
Arc Interrupter Res.(Ω)	0.7	1.4	0.8			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH/ AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	African Pavilion Transformer T-6		
Substation	African Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	27.6	**kVolt**
Type	SM-5	**Current**	300	**Amps**
Style/Cat #	86641R1	**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	153-4
Style/Cat #	134060R4	**Amps**	40E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	3 Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	1760	1733	1760			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-6		
Substation	African Pavilion		

Power Transformer -Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	Y-Y		
Type	LNAN		**Serial #.**	795154		
Neutral	Solid		**Liquid Type/Vol**	Askarel	350	**Gal**
Rating	750/ 850	**kVA**	**Total Weight**	11,900		**lbs.**
Impedance	6.0	**%**	**Primary Voltage**	27.6/ 16		**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	208/ 120		**Volt**
Frequency	60	**Hz**	**BIL**	150/ 45		**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 1k VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	27.2	27.8	
Corrected to 20 °C.	76.2	77.8	

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X1 H0-H1**	**X0-X2 H0-H2**	**X0-X3 H0-H3**
1					
2					
3	27,600	0.754	0.747	0.747	0.747
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 17, 1999
File Number	6621	**Sampled By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-6		
Substation	Africa Pavilion		

Oil Analysis

Transformer Data

Manufacturer	Westinghouse	**Primary Volts**	27.6/ 16	**kVolts**
Type	LNAN	**Rating**	750/ 850	**kVA**
Serial No.	795154	**Liquid Volume**	350	**Gals.**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
				1999
Dielectric Breakdown	D877	30 kV		46.9
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.004
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)		1.520
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)				
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB fluid
Dissolved Gas Content	---

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH/ RPM/ TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-6		
Substation	African Pavilion		

Power Transformer -Mechanical

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Breather & Silica Gel	N/A	
Explosion Vent Gaskets	N/A	
Pressure Relief Device	OK	
Conservator Tank Gaskets	N/A	
Inspection Cover Gaskets	OK	
Main Cover Gaskets	N/A	
Primary Bushing Gaskets	OK	
Primary Bushing Porcelain	OK	
Primary Bushing Connections	OK	
Secondary Bushing Gaskets	OK	
Secondary Bushing Porcelain	OK	
Secondary Bushing Connections	OK	
Secondary Throat Gaskets	OK	
Radiator	OK	
Pressure Gauge	OK	-7 PSI Vacuum
Gas Relay	N/A	
Oil Level	OK	
Oil Leaks	OK	None visible
Tank Valves	OK	
Oil Temperature Gauge	OK	
Oil Temperature Run/Max	35 / 45°C	
Winding Temperature Gauge	N/A	
Winding Temperature Run/Max	/	
Tap Changer		Unit Locked: Inoperable
Paint Condition	OK	
Pad	OK	
Grounding	OK	
Fan Operation	N/A	
Control Wiring	N/A	
Results Satisfactory	**OK**	

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T.S. P_Trans_Mech

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH/ TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-6 Secondary		
Substation	African Pavilion		

Bus Duct

Nameplate Data

Manufacturer	Square D	**Voltage**	120/ 208	**Volts**
Type	Power Clad	**Current**	3000	**Amps**
Style	3 Phase, 4 Wire	**B.I.L.**		**kVolts**
Cat #	AF-510-23-FES	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Bus Insulation	OK	
Type of Bus Insulation	OK	
Support Insulators	OK	
Interior Clean	OK	Visible Sections Only
Interior Dry	OK	Visible Sections Only
Bus Duct Enclosure	OK	
Bus Duct Enclosure Ventilated	N/A	
Bus Joints Clean & Dry	OK	
Bus Joints Torqued	OK	
Gaskets at Joints	OK	
Grounding	OK	
Enclosure Paint Condition	OK	
Support Structure	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*N*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	1170	1570	1920	---	1080	1980	3180

Comments	
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	RPM/ TL/ KH
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	African Pavilion		

Low Voltage Air Circuit Breaker

Nameplate Data

Manufacturer	FPE	**Voltage**	600	**Volts**
Type	75H-2	**Frame Rating**	3000	**Amps**
Serial #	TH-4126-72	**Int. Rating**	75	**kAmps**
Relay Type	Carriere FB600E	**Sensors Ratio**	3000:1	**Amps**
Rating Plug.	---	**Limiter Rating**	N/A	**Amps**

Relay Calibration Results

	Settings		ϕA		ϕB		ϕC	
	P/U	**T.D**	**P/U**	**T.D.**	**P/U**	**T.D.**	**P/U**	**T.D.**
Long Time	0.85x	7.5		6.021		5.896		
Short Time	7x	0.4		0.477		0.476		0.471
Instantaneous	10x			0.094		0.103		0.111
			P/U	**T.D.**				
Ground Fault	1200	0.066						

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	OK	
Bus & Grounding Stabs	OK	
Interlocks	OK	
Manual Operation	POOR	See Deficiencies
Electrical Operation		

Electrical Tests

Test Description	ϕA	ϕB	ϕC	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	40/ 70	49/ 50	49/ 48			
Results Satisfactory	*NO. See Deficiencies.*					

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Entrance/ Administration Building

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Eurasia Pavilion		
Substation	Entrance/ Administration Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	CDT-2765378	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	58	61	65			
Arc Interrupter Res.(Ω)	2.0	0.4	1.9			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Indo-Malaya Pavilion		
Substation	Entrance/ Administration Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34163	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock		
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	77	83	86			
Arc Interrupter Res.(Ω)	0.43	0.40	0.40			
Results Satisfactory	OK					

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T.S. HV_ABS

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Village Edge South		
Substation	Entrance/ Administration Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	SM Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563-R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock		
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	28	28	35			
Arc Interrupter Res.(Ω)	0.3	0.3	0.5			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Village Edge South		
Substation	Entrance/ Administration Building		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134125R4	**Amps**	80E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	Fair	One only in cell door

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	780	802	802			
Results Satisfactory	OK. Spare Links Required.					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-7		
Substation	Entrance/ Administration Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	SM Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	71	72	75			
Arc Interrupter Res.(Ω)	0.4	0.2	0.2			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-7		
Substation	Entrance/ Administration Building		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	153-4
Style/Cat #	86644R1	**Amps**	15E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	In Cell Door

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	5276	5318	5400			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-7		
Substation	Entrance/ Administration Building		

Power Transformer –Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	Wye Wye		
Type	LNAN		**Serial #.**	827694		
Neutral	Solid		**Liquid Type/Vol**	Askarel	200	**Gal**
Rating	225	**kVA**	**Total Weight**	6450		**lbs.**
Impedance	5.9	**%**	**Primary Voltage**	27.6 Y		**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	120/ 208		**Volt**
Frequency	60	**Hz**	**BIL**	150		**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 1k VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	30	30	
Corrected to 20 °C.			

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X1 H0-H1**	**X0-X2 H0-H2**	**X0-X3 H0-H3**
1					
2					
3	27,600	0.753	0.748	0.748	0.748
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 15, 1999
File Number	6621	**Sampled By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-7		
Substation	Entrance/ Administration Building		

Oil Analysis

Transformer Data

Manufacturer	Westinghouse	**Primary Volts**	27.6/ 16	**kVolts**
Type	LNAN	**Rating**	225	**kVA**
Serial No.	827694	**Liquid Volume**	200	**Gals.**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
			1999	
Dielectric Breakdown	D877	30 kV		49.4
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.004
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91		1.420
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)				
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB Insulating Fluid
Dissolved Gas Content	

T.S.

T.S. Oil_Analysis

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-8		
Substation	Entrance/ Administration Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	SM Alduti Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	43	49	43			
Arc Interrupter Res.(Ω)	0.3	0.3	0.4			
Results Satisfactory	OK					

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Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	AS, AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-8		
Substation	Entrance/ Administration Building		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	153-4
Style/Cat #	13440R4	**Amps**	25E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	In cell door

Electrical Tests

Test Description	*φA*	*φ B*	*φ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	2439	2412	2451			
Results Satisfactory	OK					

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T.S. HV_Fuse

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-8		
Substation	Entrance/ Administration Building		

Power Transformer –Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	Wye Wye		
Type	LNAN		**Serial #.**	850912		
Neutral	Solid		**Liquid Type/Vol**	Askarel	240	**Gal**
Rating	500	**kVA**	**Total Weight**	8500		**lbs.**
Impedance	6.7	**%**	**Primary Voltage**	27.6 Y		**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	600		**Volt**
Frequency	60	**Hz**	**BIL**	150		**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 1k VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	32	32	
Corrected to 20 °C.			

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X1 H0-H1**	**X0-X2 H0-H2**	**X0-X3 H0-H3**
1					
2					
3	27,600	2.173	2.178	2.178	2.178
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 15, 1999
File Number	6621	**Sampled By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Entrance Facilities Transformer T-8		
Substation	Entrance/ Administration Building		

Oil Analysis

Transformer Data

Manufacturer	Westinghouse	**Primary Volts**	27.6/ 16	**kVolts**
Type	LNAN	**Rating**	225	**kVA**
Serial No.	850912	**Liquid Volume**	240	**Gals.**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
				99
Dielectric Breakdown	D877	30 kV		49.0
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.004
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91		1.520
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)				
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB Insulating Fluid
Dissolved Gas Content	

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.			
Substation	Zoological		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	29	**kVolts**
Type	Alduti Rupter Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	CDT-2768678	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	60	58	56			
Arc Interrupter Res.(Ω)	1.3	1.1	1.5			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.			
Substation	Zoological		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5	**Current**	600	**Amps**
Style/Cat #	86644R2	**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134025R4	**Amps**	15E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	3 Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	5130	4865	5065			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	KH/ TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Zoological		

Pad-Mounted Distribution Transformer

Transformer Nameplate Data

Manufacturer	CARTE		**Year Built**	1985	
Type	ONAN		**Serial #**	NO790-1	
Neutral	Solid		**Liquid Type/Vol**	Oil 872	**Litres**
Rating	300	**kVA**	**Total Weight**	1909	**Kg**
Impedance	4.58	**%**	**Primary Voltage**	27.6/ 16	**KVolt**
Phase(s)	3	**ϕ**	**Secondary Voltage**	208/ 120	**Volt**
Frequency	60	**Hz**	**BIL**	150	**kVolt**
Insulation Resistance (MΩ)					

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	36.3
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	31.3
Specific Gravity	**D1298**	**0.84 - 0.91**	0.859
Colour	**D1500**	**≤3.5 Max.**	<0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Service Building

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Main Switchgear		
Substation	Service Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	58	59	57			
Arc Interrupter Res.(Ω)	0.3	0.3	0.3			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to North America Pavilion		
Substation	Service Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	56	55	57			
Arc Interrupter Res.(Ω)	0.5	0.6	0.5			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeder WEST/ EAST		
Substation	Service Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T5	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*WEST*	*EAST*				
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	57	60	---			
Arc Interrupter Res.(Ω)	0.6	0.7	---			
Results Satisfactory	OK. Single phase feeds x2					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeder WEST/ EAST		
Substation	Service Building		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300	**Amps**
Style/Cat #		**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134125R4	**Amps**	80E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	

Electrical Tests

Test Description	*WEST*	*EAST*				
Insulation Resistance (GΩ)	>505	>505	---	---	---	---
Contact Resistance (μΩ)	830	859	---			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Service Building		
Substation	Service Building		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	51	50	46			
Arc Interrupter Res.(Ω)	0.3	0.3	0.3			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Feeder to Service Building X-Former #4		
Substation	Service Building		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134100R4	**Amps**	65E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	1136	1044	1021			
Results Satisfactory	OK					

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T.S. HV_Fuse

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T1 27.6kV-600V 3ϕ 4W From HV Board		
Substation	Service Building		

Power Transformer -Electrical

Nameplate Data

Manufacturer	Hammond		**Vector Group**	Wye Wye		
Type	ANN/ AFN		**Serial #.**	DB93F		
Neutral	Solid		**Liquid Type/Vol**	Dry	Type	**Gal**
Rating	1500/ 2000	**kVA**	**Total Weight**	16500		**lbs.**
Impedance	5.7	**%**	**Primary Voltage**	27.6/ 15.935		**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	600/ 347		**Volt**
Frequency	60	**Hz**	**BIL**	150		**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 1k VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	10,000	10,000	10,000
Corrected to 20 °C.			

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X2 H1-H2**	**X0-X3 H2-H3**	**X0-X1 H3-H1**
1	28,980				
2	28,290				
3	27,600	2.177	2.174	2.174	2.174
4	26,910				
5	26,220				

Tap Position Found & Left	3-4 (27,600V)
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC/ EJ
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Secondary Breaker from T1		
Substation	Service Building		

Low Voltage Air Circuit Breaker

Nameplate Data

Manufacturer	FPE	**Voltage**	600	**Volts**
Type	75H-3	**Frame Rating**	3000	**Amps**
Serial #	BH-45339-93	**Int. Rating**	65	**kAmps**
Relay Type	USR	**Sensors Ratio**		**Amps**
Rating Plug.		**Limiter Rating**	N/A	**Amps**

Relay Calibration Results

	Settings		ϕA		ϕB		ϕC	
	P/U	**T.D**	**P/U**	**T.D.**	**P/U**	**T.D.**	**P/U**	**T.D.**
Long Time	2x	1.1x						
Short Time	3X	0.3						
Instantaneous	OFF							
			P/U	**T.D.**				
Ground Fault	0.6	0.45						

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	OK	
Bus & Grounding Stabs	OK	
Interlocks	0K	
Manual Operation	OK	
Electrical Operation	N/A	

Electrical Tests

Test Description	ϕA	ϕB	ϕC	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	26	25	25			
Results Satisfactory	OK					

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Eurasia Pavilion

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Main Switchgear		
Substation	Eurasia Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063R2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	236	232	278	>505	>505	>505
Contact Resistance (μΩ)	48	52	61			
Arc Interrupter Res.(Ω)	1.2	1.3	1.6			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM/ AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Entrance Facilities		
Substation	Eurasia Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063R2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	236	232	278	>505	>505	>505
Contact Resistance (μΩ)	39	42	40			
Arc Interrupter Res.(Ω)	3.1	2.0	3.6			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM/ AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeders (Centre & South)		
Substation	Eurasia Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	SM-Alduti-Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34363R4-T5	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	POOR	Kirk RE12023 & RE12019
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)						
Contact Resistance (μΩ)	60	---	58			
Arc Interrupter Res.(Ω)	1.9	---	0.6			
Results Satisfactory	*See Deficiencies.*					

T.S.

T.S. HV_ABS

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM/ AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Paddock Feeders (Centre & South)		
Substation	Eurasia Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #		**Serial #**		

Fuse Link Nameplate Data			
Type	SM-5	**TCC**	153-4
Style/Cat #	134125R	**Amps**	80E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	Fair	Only One Spare Present in Cell

Electrical Tests

Test Description	*φA*	*φ B*	*φ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	966	---	1286			
Results Satisfactory	Fair. See Recommendations.					

T.S.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Eurasia Pavilion Transformer –T1		
Substation	Eurasia Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	SM-Alduti-Indoor	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	236	232	278	>505	>505	>505
Contact Resistance (μΩ)	41	42	44			
Arc Interrupter Res.(Ω)	0.9	1.2	0.4			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM/ AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Eurasia Pavilion Trans. #1		
Substation	Eurasia Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134025R4	**Amps**	15E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	3 Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	6020	5940	6080			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM/ TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Eurasia Pav. Trans. T-1		
Substation	Eurasia Pavilion		

Power Transformer –Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	Y-Y		
Type	LNAN		**Serial #.**	849380		
Neutral	Solid		**Liquid Type/Vol**	Askarel	200	**Gal**
Rating	225/ 252	**kVA**	**Total Weight**	6450		**lbs.**
Impedance	5.9	**%**	**Primary Voltage**	27.6/ 16		**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	208/ 120		**Volt**
Frequency	60	**Hz**	**BIL**	150/ 45		**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 500 VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	40.0	34.2	
Corrected to 20 °C.	112.0	95.8	

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X1 H0-H1**	**X0-X2 H0-H2**	**X0-X3 H0-H3**
1					
2					
3	27,600	0.754	0.746	0.746	0.746
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

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T.S. P_Trans_Elect

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 18, 1999
File Number	6621	**Sampled By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-1		
Substation	Eurasia Pavilion		

Oil Analysis

Transformer Data

Manufacturer	Westinghouse	**Primary Volts**	27.6/ 16	**kVolts**
Type	LNAN	**Rating**	225/ 252	**kVA**
Serial No.	849380	**Liquid Volume**	200	**Gals.**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
				1999
Dielectric Breakdown	D877	30 kV		48.8
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.008
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)		1.520
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)				
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB fluid
Dissolved Gas Content	---

T.S.

T.S. Oil_Analysis

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Eurasia Pavilion Transformer T-1		
Substation	Eurasia Pavilion		

Power Transformer -Mechanical

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Breather & Silica Gel	N/A	
Explosion Vent Gaskets	N/A	
Pressure Relief Device	OK	
Conservator Tank Gaskets	N/A	
Inspection Cover Gaskets	OK	
Main Cover Gaskets	N/A	
Primary Bushing Gaskets	OK	
Primary Bushing Porcelain	POOR	H3 top skirt split/ cracked
Primary Bushing Connections	OK	
Secondary Bushing Gaskets	OK	
Secondary Bushing Porcelain	OK	
Secondary Bushing Connections	OK	
Secondary Throat Gaskets	OK	
Radiator	OK	
Pressure Gauge	OK	-0.8 PSI Vacuum
Gas Relay	N/A	
Oil Level	OK	
Oil Leaks	OK	None Visible
Tank Valves	OK	
Oil Temperature Gauge	OK	
Oil Temperature Run/Max	34 | 41°C	
Winding Temperature Gauge	N/A	
Winding Temperature Run/Max	|	
Tap Changer		Unit Locked: Inoperable
Paint Condition	OK	
Pad	OK	
Grounding	OK	One-point grounding
Fan Operation	N/A	
Control Wiring	N/A	
Results Satisfactory	**Fair.** ***See Deficiencies.***	

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-1 Secondary		
Substation	Eurasia Pavilion		

Bus Duct

Nameplate Data

Manufacturer	Square D	**Voltage**	600	**Volts**
Type	I-Line	**Current**	800	**Amps**
Style	3 Phase, 4 Wire	**B.I.L.**		**kVolts**
Cat #	AF-510-23-FES	**Serial #**	T1	

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Bus Insulation	OK	
Type of Bus Insulation	OK	
Support Insulators	OK	
Interior Clean	OK	Visible Sections Only
Interior Dry	OK	Visible Sections Only
Bus Duct Enclosure	OK	
Bus Duct Enclosure Ventilated	N/A	
Bus Joints Clean & Dry	OK	
Bus Joints Torqued	OK	
Gaskets at Joints	OK	
Grounding	OK	
Enclosure Paint Condition	OK	
Support Structure	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*N*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	2060	1990	2250	—	4780	4980	5500

Comments	
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	Eurasia Pavilion		

Low Voltage Air Circuit Breaker

Nameplate Data

Manufacturer	ITE	**Voltage**	600	**Volts**
Type	K-1600	**Frame Rating**	1600	**Amps**
Serial #	98013	**Int. Rating**	65	**kAmps**
Relay Type	OD4 Dashpots Only	**Sensors Ratio**	800	**Amps**
Rating Plug.		**Limiter Rating**	N/A	**Amps**

Relay Calibration Results

	Settings		ϕA		ϕB		ϕC	
	P/U	**T.D**	**P/U**	**T.D.**	**P/U**	**T.D.**	**P/U**	**T.D.**
Long Time	800A	Inst.						
Short Time	3200A							
Instantaneous								
			P/U	**T.D.**				
Ground Fault	---							

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	OK	
Bus & Grounding Stabs	OK	
Interlocks	OK	Rack Out Only
Manual Operation	OK	
Electrical Operation	N/A	

Electrical Tests

Test Description	ϕA	ϕB	ϕC	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	58	64	52			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Weston Station Transformer		

Padmounted Distribution Transformer

Transformer Nameplate Data

Manufacturer	Federal Pioneer		**Year Built**	1976		
Type	ONAN		**Serial #**	A11808-1		
Neutral	Solid		**Liquid Type/Vol**	Oil	260	**Gal**
Rating	225	**kVA**	**Total Weight**	4650		**lbs.**
Impedance		**%**	**Primary Voltage**	27.6/ 16		**kVolt**
Phase(s)	3	**ϕ**	**Secondary Voltage**	208/ 120		**Volt**
Frequency	60	**Hz**	**BIL**			**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	37.4
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	27.1
Specific Gravity	**D1298**	**0.84 - 0.91**	0.853
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• IFT of the oil is marginal. • ***This station's switchgear was reported to be in POOR condition***
Results Satisfactory:	*FAIR/ Poor*

T.S.

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Indo-Malaya Pavilion

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Loop Feeder to Entrance Facilities		
Substation	Indo-Malaya Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	Fair	Bϕ terminator skirt broken off.
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (GΩ)	438	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	55	47	52			
Arc Interrupter Res.(Ω)	0.9	0.6	0.7			
Results Satisfactory	OK/ Fair. *See Deficiencies.*					

T.S.

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Africa Pavilion		
Substation	Indo-Malaya Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34063	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕ A*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	62	56	52			
Arc Interrupter Res.(Ω)	0.6	0.7	0.5			
Results Satisfactory	OK					

T.S.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Indo-Malaya Paddock Feeder		
Substation	Indo-Malaya Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolts**
Type	SM-Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T5	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	Poor	Operator is defective
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	---	---	62			
Arc Interrupter Res.(Ω)	---	---	*			
Results Satisfactory	Fair. See Deficiencies.					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Indo-Malaya Paddock Feeder		
Substation	Indo-Malaya Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	34.5	**kVolt**
Type	SM-5	**Current**	300	**Amps**
Style/Cat #	86644R1	**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	
Style/Cat #		**Amps**	

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	Poor	No Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕ B*	*ϕ C*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)			1015			

Results Satisfactory	Fair. Spare links required.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Indo-Malaya Transformer T2		
Substation	Indo-Malaya Pavilion		

High Voltage Air/Load Break Switch

Nameplate Data

Manufacturer	S&C	**Voltage**	27	**kVolts**
Type	SM - Alduti	**Current**	600	**Amps**
Style #		**B.I.L.**	150	**kVolts**
Cat #	34563R4-T2	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	Fair	Surfaces pitted
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	50	46	48			
Arc Interrupter Res.(Ω)	1.0	0.5	0.8			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Indo-Malaya Transformer T2		
Substation	Indo-Malaya Pavilion		

High Voltage Power Fuse

Fuse Holder Nameplate Data

Manufacturer	S&C	**Voltage**	27.6	**kVolt**
Type	SM-5S	**Current**	300E	**Amps**
Style/Cat #		**Serial #**		

Fuse Link Nameplate Data

Type	SM-5	**TCC**	153-4
Style/Cat #	134040R4	**Amps**	25E

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	3 Spares in Cell

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Contact Resistance (μΩ)	3024	3055	3148			
Results Satisfactory	OK					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Indo-Malaya Pavilion Trans. T-2		
Substation	Indo-Malaya Pavilion		

Power Transformer -Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	Y-Y		
Type	LNAN		**Serial #.**	795156		
Neutral	Solid		**Liquid Type/Vol**	Askarel	220	**Gal**
Rating	500/ 560	**kVA**	**Total Weight**	8500		**lbs.**
Impedance	7.1	**%**	**Primary Voltage**	27.6/ 16		**kVolt**
Phase	3	**ϕ**	**Secondary Voltage**	208/ 120		**Volt**
Frequency	60	**Hz**	**BIL**	150/ 45		**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 1k VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	28.0	24.2	
Corrected to 20 °C.	78.4	67.8	

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)					
Corr. 20 °C					
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X1 H0-H1**	**X0-X2 H0-H2**	**X0-X3 H0-H3**
1					
2					
3	27,600	0.754	0.746	0.746	0.746
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 17, 1999
File Number	6621	**Sampled By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-2		
Substation	Indo-Malaya Pavilion		

Oil Analysis

Transformer Data

Manufacturer	Westinghouse	**Primary Volts**	27.6/ 16	**kVolts**
Type	LNAN	**Rating**	500/ 560	**kVA**
Serial No.	795156	**Liquid Volume**	220	**Gals.**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
				1999
Dielectric Breakdown	D877	30 kV		48.1
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.012
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)		1.420
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)				
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB fluid
Dissolved Gas Content	---

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-2		
Substation	Indo-Malaya Pavilion		

Power Transformer -Mechanical

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Breather & Silica Gel	N/A	
Explosion Vent Gaskets	N/A	
Pressure Relief Device	OK	
Conservator Tank Gaskets	N/A	
Inspection Cover Gaskets	OK	
Main Cover Gaskets	N/A	Welded Top
Primary Bushing Gaskets	OK	
Primary Bushing Porcelain	OK	
Primary Bushing Connections	OK	
Secondary Bushing Gaskets	OK	
Secondary Bushing Porcelain	OK	
Secondary Bushing Connections	OK	
Secondary Throat Gaskets	OK	
Radiator	OK	
Pressure Gauge	OK	-0.5 lb. Vacuum
Gas Relay	N/A	
Oil Level	OK	
Oil Leaks	OK	None Present
Tank Valves	OK	
Oil Temperature Gauge	OK	
Oil Temperature Run/Max	37 | 40°c	
Winding Temperature Gauge	N/A	
Winding Temperature Run/Max	|	
Tap Changer		Unit Locked: Inoperable
Paint Condition	OK	
Pad	OK	
Grounding	OK	One-point grounding
Fan Operation	N/A	
Control Wiring	N/A	
Results Satisfactory	**OK**	

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-2 Secondary		
Substation	Indo-Malaya Pavilion		

Bus Duct

Nameplate Data

Manufacturer	FPE	**Voltage**	120/208	**Volts**
Type	Power Clad	**Current**	1600	**Amps**
Style	3 Phase, 4 Wire	**B.I.L.**		**kVolts**
Cat #	08-01599	**Serial #**		

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Bus Insulation	OK	
Type of Bus Insulation	OK	
Support Insulators	OK	
Interior Clean	OK	Visible Sections Only
Interior Dry	OK	Visible Sections Only
Bus Duct Enclosure	OK	
Bus Duct Enclosure Ventilated	N/A	
Bus Joints Clean & Dry	OK	
Bus Joints Torqued	OK	
Gaskets at Joints	OK	
Grounding	OK	
Enclosure Paint Condition	OK	
Support Structure	OK	

Electrical Tests

Test Description	*ϕA*	*ϕB*	*ϕC*	*N*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	1260	1140	1090	---	1980	2160	3280

Comments	
Results Satisfactory	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	Indo-Malaya Pavilion		

Low Voltage Air Circuit Breaker

Nameplate Data

Manufacturer	FPE	**Voltage**	600	**Volts**
Type	50H-2	**Frame Rating**	1600	**Amps**
Serial #	TH-4123.72	**Int. Rating**	50	**kAmps**
Relay Type	Carriere FB600E	**Sensors Ratio**	1600:1	**Amps**
Rating Plug.	---	**Limiter Rating**	N/A	**Amps**

Relay Calibration Results

	Settings		ϕA		ϕB		ϕC	
	P/U	**T.D**	**P/U**	**T.D.**	**P/U**	**T.D.**	**P/U**	**T.D.**
Long Time	0.9x	7.5		5.809		5.881		5.963
Short Time	6x	0.40		0.451		0.445		0.450
Instantaneous	10x			0.055		0.065		0.064
			P/U	**T.D.**				
Ground Fault	0.4x	0.4		0.415				

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	Fair/ Poor	Front Barrier Missing
Bus & Grounding Stabs	OK	
Interlocks	OK	Rack Out Only
Manual Operation	OK	
Electrical Operation	N/A	

Electrical Tests

Test Description	ϕA	ϕB	ϕC	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	14	17	22			
Results Satisfactory	OK/ Fair					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	DP MB		
Substation	Indo-Malaya Pavilion		

Low Voltage Air Circuit Breaker

Nameplate Data

Manufacturer	FPE	**Voltage**	600	**Volts**
Type	50H-2	**Frame Rating**	1600	**Amps**
Serial #	TH-4124/72	**Int. Rating**	50	**kAmps**
Relay Type	Carriere FB600E	**Sensors Ratio**	1600:1	**Amps**
Rating Plug.	---	**Limiter Rating**	N/A	**Amps**

Relay Calibration Results

	Settings		ϕA		ϕB		ϕC	
	P/U	**T.D**	**P/U**	**T.D.**	**P/U**	**T.D.**	**P/U**	**T.D.**
Long Time	0.65x	7.5		5.945		6.204		6.110
Short Time	4x	0.25		0.282		0.300		0.284
Instantaneous	6x			0.124		0.104		0.108
			P/U	**T.D.**				
Ground Fault	0.4x	0.4		0.26				

Mechanical Inspections

Description of Inspection	*Status*	*Comments*
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	Fair	Front Barriers Cracked
Bus & Grounding Stabs	OK	
Interlocks	OK	Rack Out Only
Manual Operation	Poor (as found)	Mechanism restored to operation
Electrical Operation	N/A	

Electrical Tests

Test Description	ϕA	ϕB	ϕC	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	32	24	28			
Results Satisfactory	Fair as found.					

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Cable Tests

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14-18, 1999
File Number	6621	**Tested By**	RPM/ KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Loop Feed Underground Power Cables		
Substation	Various		

Power Cable Inspection

Cable Nameplate Data

Manufacturer		**Voltage**	28	**kVolts**
Insulation Type	XLPE	**Ambient Temp.**		**OC**
Conductor Type	Copper (CU)	**Humidity**		**%**

Electrical Test

	Insulation Resistance (MΩ)					
Feeder Identification	**ϕA**	**ϕB**	**ϕC**	**A/B**	**B/C**	**C/A**
Incoming Outdoor 27.6kV Feeder	68,000	7,700	725	18,100	4,900	34,000
Main Switchgear to Eurasia Pavilion	750	790	785	3,960	4,080	3,920
Main Switchgear to Service Building	805	800	680	4,180	3,700	3,760
Service Bld. to N. America Pavilion	680	710	660	3,400	3,400	3,200
N. America to Africa Pavilion	670	715	680	3,500	3,600	3,380
Africa to Indo-Malaya Pavilion	665	555	665	3,000	3,000	3,340
Ent./ Admin. to Eurasia Pavilion (with Lightning Arrestors connected)	386	396	402	2,040	2,100	2,040
Ent./ Admin. to Indo-Malaya Pavilion	760	810	760	4,080	3,980	3,940

Results Satisfactory	

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T.S. Power_Cable

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 28, 1999
File Number	6693	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Loop Feed to Indo-Malaya Pavilion *(tested after ϕB splice repair)*		
Substation	Africa Pavilion		

Cable High-Potential Test

Cable Nameplate Data

Manufacturer		**Voltage**	28	**kVolts**
Insulation Type	XLPE	**Conductor Size**	3/0	**MCM**
Conductor Type	Copper (CU)	**Temp. & Hum.**	28	OC

Electrical Test

Test Voltage @ 25 kVdc.	**Leakage Current**		
Voltage Increments	**ϕ A**	**ϕ B**	**ϕ C**
5 kV	17	14	13
10 kV	35	33	39
15 kV	55	47	27
20 kV	45	50	32
25 kV	64	68	46
Time at Test Voltage			
30 Seconds	46	48	27
1 Minute	43	46	25
2 Minutes	39	44	23
3 Minutes	36	43	20
4 Minutes	35	42	18
5 Minutes	34	41	17
6 Minutes			
7 Minutes			
8 Minutes			
9 Minutes			
10 Minutes			
11 Minutes			
12 Minutes			
13 Minutes			
14 Minutes			
15 Minutes			

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)	675	436	1270	1210	1530	1880
Results Satisfactory	ϕC in best condition of 3 cables tested.					

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 25, 1999
File Number	6693	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Loop Feed to North America Pavilion *(tested after ϕB splice repair)*		
Substation	Africa Pavilion		

Cable High-Potential Test

Cable Nameplate Data

Manufacturer	Pirelli	**Voltage**	28		**kVolts**
Insulation Type	XLPE	**Conductor Size**	3/0		**MCM**
Conductor Type	Copper (CU)	**Temp. & Hum.**		28	**OC**

Electrical Test

Test Voltage @ 25 kVdc.	**Leakage Current**		
Voltage Increments	**ϕ A**	**ϕ B**	**ϕ C**
4 kV	63	87	35
8 kV	80	79	43
12 kV	141	98	57
16 kV	149	142	63
20 kV	157	124	105
Time at Test Voltage			
30 Seconds	0.8	48	8
1 Minute	0.7	46	0
2 Minutes	0.7	44	0
3 Minutes	0.8	43	0
4 Minutes	0.9	42	0
5 Minutes	0.7	41	0
6 Minutes			
7 Minutes			
8 Minutes			
9 Minutes			
10 Minutes			
11 Minutes			
12 Minutes			
13 Minutes			
14 Minutes			
15 Minutes			

Test Description	*ϕA*	*ϕB*	*ϕC*	*A/B*	*B/C*	*C/A*
Insulation Resistance (MΩ)						
Results Satisfactory	ϕC in best condition of 3 cables tested.					

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T.S. HV_Hypot

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Technical Field Service Department

31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

SUBMERSIBLE
Distribution Transformers

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	KH/RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #1		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	971935		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	36.5
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	32.9
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• H1B elbow burnt. • Elbow & transformer bushing insert should be replaced.
Results Satisfactory:	*POOR*

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #2		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	McGraw Edison		**Year Built**			
Type	ONAN		**Serial #**	336007-2		
Neutral	Solid		**Liquid Type/Vol**	Oil	255	**Lit**
Rating	100	**kVA**	**Total Weight**	522		**Kg**
Impedance	1.7	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	39.5
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.007
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	29.5
Specific Gravity	**D1298**	**0.84 - 0.91**	0.860
Colour	**D1500**	**≤3.5 Max.**	1.0
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	-Red phase connection found loose at the tank. -IFT is borderline. Monitor for deterioration.
Results Satisfactory:	OK/ Fair

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #6		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	861979		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	35.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.8
Specific Gravity	D1298	0.84 - 0.91	0.849
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM/JRK/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #7		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 861975** **White Ø: 861980** **Blue Ø: 871930**		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	**D877**	**30 kV Min.**	45.1	37.7	49.4
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.028	0.021	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	31.9	31.4	31.7
Specific Gravity	**D1298**	**0.84 - 0.91**	0.849	0.849	0.849
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	• Below marginal oil levels on all units.
Results Satisfactory:	Fair.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	RPM/TL
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #8		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 871939** **White Ø: 871938** **Blue Ø: WO383007**		
Neutral	Solid		**Liquid Type/Vol**	Oil	27	**Gal**
Rating	50	**kVA**	**Total Weight**	770		**Lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**KVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**KVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	**White**	**Blue**
Dielectric Breakdown	**D877**	**30 kV Min.**	42.5	43.1	43.0
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.007	0.021	0.020
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	30.9	31.4	26.6
Specific Gravity	**D1298**	**0.84 - 0.91**	0.850	0.853	0.859
Colour	**D1500**	**≤3.5 Max.**	0.5	1.0	<0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	-Red phase oil level is marginal. -Blue phase vault initially inaccessible. The water level in this vault does cover the transformer at times. -Blue phase IFT is borderline. -White phase vault ground to lid is off.
Results Satisfactory:	OK/ Fair

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Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #11		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	861953		
Neutral	Solid		**Liquid Type/Vol**	Oil	34	**Gal**
Rating	75	**kVA**	**Total Weight**	1080		**lbs.**
Impedance	20	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	47.5
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.034
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	34.8
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• No lock on lid • Both hinges broken
Results Satisfactory:	OK

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Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault 11A		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Carte		**Year Built**	1988		
Type	ONAN		**Serial #**	Q1431-28		
Neutral	Solid		**Liquid Type/Vol**	Oil	186	**Lit**
Rating	75	**kVA**	**Total Weight**	451		**Kg**
Impedance	2.29	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	46.7
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.013
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	35.2
Specific Gravity	**D1298**	**0.84 - 0.91**	0.876
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• No lock on vault
Results Satisfactory:	OK

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T.S. P_Trans_Elect

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM/JRK/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #12		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1974		
Type	ONAN		**Serial #'s**	**Red Ø: 861968** **White Ø:861963** **Blue Ø: 861987**		
Neutral	Solid		**Liquid Type/Vol**	Oil	27	**Gal**
Rating	50	**kVA**	**Total Weight**	770		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	**White**	**Blue**
Dielectric Breakdown	**D877**	**30 kV Min.**	38.4	42.8	37.1
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.028	0.014	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	30.1	30.0	30.4
Specific Gravity	**D1298**	**0.84 - 0.91**	0.850	0.851	0.849
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	- Oil levels marginal.
Results Satisfactory:	OK

T.S.

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #13 – Old Elephant House		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 861950** **White Ø: 861-954** **Blue Ø: 861951**		
Neutral	Solid		**Liquid Type/Vol**	Oil	34	**Gal**
Rating	75	**kVA**	**Total Weight**	1080		**lbs.**
Impedance	2.0	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**			**125lt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	**White**	**Blue**
Dielectric Breakdown	**D877**	**30 kV Min.**	47.4	38.7	42.7
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.028	0.028	0.041
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	32.7	32.4	30.6
Specific Gravity	**D1298**	**0.84 - 0.91**	0.484	0.847	0.853
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	1.0
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	- Blue phase oil level below manufacturer's indication line.
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #13A		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1982		
Type	ONAN		**Serial #'s**	**Red Ø: LG37989** **White Ø: LG37991** **Blue Ø: LG37990**		
Neutral	Solid		**Liquid Type/Vol**	Oil	70	**Gal**
Rating	25	**kVA**	**Total Weight**	240		**lbs.**
Impedance	1.8	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	**D877**	**30 kV Min.**	44.4	47.6	41.8
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014	0.021	0.027
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	30.0	25.7	29.5
Specific Gravity	**D1298**	**0.84 – 0.91**	0.856	0.853	0.856
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	• The oil levels of these units were noted as marginal during the inspection. • Note the marginal White ϕ IFT. • The White phase unit subsequently failed and was replaced. (See following Oil test sheet for new unit lab results)
Results Satisfactory:	OK/ Fair

Black & McDonald

TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	**Sample Date**	June 28, 1999
File Number	6621	**Sampled By**	JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #13A Pachyderm Centre/ White phase		
Substation	Outside Elephant Paddock (Fed from Africa Pavilion)		

Oil Analysis

Transformer Data

Manufacturer	Cam Tran Co.	**Primary Volts**	27.6/ 16	**kVolts**
Type	ONAN Submersible	**Rating**	100	**kVA**
Serial No.	99C0846101	**Liquid Volume**	194	**Litres**

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV	42.1
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.027
Interfacial Tension	D971	32 Dynes/ Cm Min.	37.7
Specific Gravity	D1298	0.84 - 0.91	0.818
Colour	D1500	≤3.5	<0.5
Visual Condition	D1524	Clear	Clear
Water Content	D1533	30 ppm (<69kV)	
Power Factor	D924	1.0 % Max @ 25 °C	0.014%
PCB Content	D4059	50 ppm Max.	
Inhibitor	D2668	≥0.20%	
Furans	D5837	<100 ppb	
Hydrogen (H2)			
Oxygen & Argon			
Nitrogen (N2)			
Methane (CH4)			
Carbon Monoxide (CO)			
Carbon Dioxide (CO2)			
Ethylene (C2H4)			
Ethane (C2H6)			
Acetylene (C2 H2)			
Total Gas Content			

Comments

Chemical Properties	OK
PCB Content	N/A
Dissolved Gas Content	---

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #14		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	861970		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	44.1
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.028
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	33.4
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH/TL/AN
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #16		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973	
Type	ONAN		**Serial #'s**	**Red Ø: 861969** **White Ø: 861978** **Blue Ø: 861977**	
Neutral	Solid		**Liquid Type/Vol**	Oil / 16	**Gal**
Rating	25	**kVA**	**Total Weight**	465	**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16	**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240	**Volt**
Frequency	60	**Hz**	**BIL**	125	**kVolt**
Insulation Resistance (MΩ)					

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	43.9	37.9	46.2
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028	0.014	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.9	32.1	32.8
Specific Gravity	D1298	0.84 - 0.91	0.849	0.849	0.849
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5
Visual Condition	D1524	Clear	Clear	Clear	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

T.S.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #16		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1974		
Type	ONAN		**Serial #**	861966		
Neutral	Solid		**Liquid Type/Vol**	Oil	27	**Gal**
Rating	50	**kVA**	**Total Weight**	770		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	44.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.034
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.2
Specific Gravity	D1298	0.84 - 0.91	0.850
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	IFT is borderline
Results Satisfactory:	OK

T.S.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	TL/RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #16A		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghosue		**Year Built**	1973		
Type	ONAN		**Serial #**	861974		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	41.9
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.3
Specific Gravity	D1298	0.84 - 0.91	0.849
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	• Oil level is acceptable
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	TL/RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #18 – Admin/Entrance Fed		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Carte		**Year Built**	1983		
Type	ONAN		**Serial #**	L0721-1		
Neutral	Solid		**Liquid Type/Vol**	Oil	35	**Gal**
Rating	75	**kVA**	**Total Weight**	889		**lbs.**
Impedance	2.4	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	38.2
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.034
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	18.2
Specific Gravity	**D1298**	**0.84 - 0.91**	0.857
Colour	**D1500**	**≤3.5 Max.**	1.0
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	IFT is marginal
Results Satisfactory:	Fair

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	TL/RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #20 – Eurasia Fed		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	861944		
Neutral	Solid		**Liquid Type/Vol**	Oil	38	**Gal**
Rating	100	**kVA**	**Total Weight**	1300		**lbs.**
Impedance	1.8	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	43.3
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	36.1
Specific Gravity	D1298	0.84 - 0.91	0.847
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	
Results Satisfactory:	

T.S.

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #21		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	861981		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	30.7
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	33.3
Specific Gravity	**D1298**	**0.84 - 0.91**	0.849
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• Had to pump water out of vault • Dielectric of oil is borderline
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #22		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	861973		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	463		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	42.4
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.041
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	33.8
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• Over one foot of water pumped out of vault.
Results Satisfactory:	OK

T.S.

T.S. P_Trans_Elect

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	JC
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #23		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**			
Type	ONAN		**Serial #**	871931		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	36.1
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.021
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	30.6
Specific Gravity	**D1298**	**0.84 - 0.91**	0.849
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

T.S.

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	TL/ RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #24 – Eurasia Fed		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1974		
Type	ONAN		**Serial #**	861964		
Neutral	Solid		**Liquid Type/Vol**	Oil	27	**Gal**
Rating	50	**kVA**	**Total Weight**	770		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	49.4
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.021
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	31.2
Specific Gravity	**D1298**	**0.84 - 0.91**	0.850
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• Slight mark/ burn on H1B elbow. • Some secondary cables were found cut off. These ends were taped off by our personnel.
Results Satisfactory:	OK (as left)

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	KH/RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #26		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1974	
Type	ONAN		**Serial #**	861962	
Neutral	Solid		**Liquid Type/Vol**	Oil 27	**Gal**
Rating	50	**kVA**	**Total Weight**	770	**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16	**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240	**Volt**
Frequency	60	**Hz**	**BIL**	125	**kVolt**
Insulation Resistance (MΩ)					

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	40.4
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.1
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	- Corrosion present on untaped Neutral bus/ bushing. - Sand present in vault via primary cable duct.
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	KH/ RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #27		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	871926		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	35.8
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	32.5
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	• Elbows taped by our personnel. • Vault lid has no securing nuts holding grate.
Results Satisfactory:	OK

T.S.

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 15, 1999
File Number	6621	**Tested By**	AS/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #28		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	871934		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	**D877**	**30 kV Min.**	40.8
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	30.7
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5
Visual Condition	**D1524**	**Clear**	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

T.S.

T.S. P_Trans_Elect

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	JC
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault # 29		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**			
Type	ONAN		**Serial #**	861972		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	39.3
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.9
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

T.S.

T.S. P_Trans_Elect

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 18, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #30		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 861976** **White Ø: 871932** **Blue Ø: 871933**		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	**White**	**Blue**
Dielectric Breakdown	**D877**	**30 kV Min.**	43.0	34.1	39.1
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.007	0.014	0.021
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	33.1	29.6	31.8
Specific Gravity	**D1298**	**0.84 - 0.91**	0.849	0.849	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 16, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #31		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 861940** **White Ø: 861941** **Blue Ø: 861943**		
Neutral	Solid		**Liquid Type/Vol**	Oil	38	**Gal**
Rating	100	**kVA**	**Total Weight**	1300		**lbs.**
Impedance	1.8	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	**D877**	**30 kV Min.**	40.2	37.0	38.1
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.021	0.007	0.007
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	31.6	31.1	32.3
Specific Gravity	**D1298**	**0.84 - 0.91**	0.850	0.848	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	
Results Satisfactory:	OK

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Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	JRK/RPM/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #32		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 861949** **White Ø: 961955** **Blue Ø: 861952**		
Neutral	Solid		**Liquid Type/Vol**	Oil	34	**Gal**
Rating	75	**kVA**	**Total Weight**	1080		**lbs.**
Impedance	2	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	**D877**	**30 kV Min.**	38.5	40.7	42.8
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.028	0.028	0.028
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	32.8	31.4	33.5
Specific Gravity	**D1298**	**0.84 - 0.91**	0.848	0.847	0.847
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	• Red & Blue phases' oil level marginal. • Red ϕ manhole gasket should be replaced.
Results Satisfactory:	OK/ Fair

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 17, 1999
File Number	6621	**Tested By**	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #33		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #**	871937		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	463		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	37.7
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	36.9
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments

Comments:	Vault fills over top with water
Results Satisfactory:	OK

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Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #34		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973		
Type	ONAN		**Serial #'s**	**Red Ø: 861971** **White Ø: 871927** **Blue Ø: 871936**		
Neutral	Solid		**Liquid Type/Vol**	Oil	16	**Gal**
Rating	25	**kVA**	**Total Weight**	465		**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16		**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240		**Volt**
Frequency	60	**Hz**	**BIL**	125		**kVolt**
Insulation Resistance (MΩ)						

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	**D877**	**30 kV Min.**	37.7	48.9	42.2
Neutralization Number	**D974**	**0.05 Max. Mg Koh/G**	0.028	0.014	0.014
Interfacial Tension	**D971**	**32 Dynes/ Cm Min.**	32.2	32.3	33.0
Specific Gravity	**D1298**	**0.84 - 0.91**	0.849	0.848	0.848
Colour	**D1500**	**≤3.5 Max.**	0.5	0.5	0.5
Visual Condition	**D1524**	**Clear**	Clear	Clear	Clear

Observations & Comments

Comments:	• Blue & White phases' oil levels are marginal. Blue is lower. • Signs of "corona" on White ϕ elbow. Water apparently dropping from above. • Red ϕ vault ground broken off grate. This has been repaired by our personnel.
Results Satisfactory:	FAIR

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TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	**Date**	June 14, 1999
File Number	6621	**Tested By**	RPM/JRK
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #35		

Submersible Distribution Transformer

Transformer Nameplate Data

Manufacturer	Westinghouse		**Year Built**	1973	
Type	ONAN		**Serial #'s**	**Red Ø: 971929** **White Ø: 871928** **Blue Ø: 871925**	
Neutral	Solid		**Liquid Type/Vol**	Oil 16	**Gal**
Rating	25	**kVA**	**Total Weight**	465	**lbs.**
Impedance	1.9	**%**	**Primary Voltage**	16	**kVolt**
Phase(s)	1	**ϕ**	**Secondary Voltage**	120/ 240	**Volt**
Frequency	60	**Hz**	**BIL**	125	**kVolt**
Insulation Resistance (MΩ)					

Oil Analysis

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	41.8	42.8	38.0
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021	0.021	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.4	32.7	31.7
Specific Gravity	D1298	0.84 - 0.91	0.848	0.848	0.848
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5
0isual Condition	D1524	Clear	Clear	Clear	Clear

Observations & Comments

Comments:	• Red Ø – oil level is low • Blue Ø – oil is marginal
Results Satisfactory:	Fair

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APPENDIX 20

BLACK & McDONALD – SUBMERSIBLE TRANSFORMER FAILURE/REPLACEMENT REPORT DATED AUGUST 1999, REFERENCE NO. 6637

Black & McDonald

Technical Field Service Division
31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

June 8, 1999

Metro Toronto Zoo
361A Old Finch Ave.
Scarborough, Ontario
M1B 5K7

Attention: **Mr. Dean Evans**
Maintenance/ Facilities Supervisor
Subject: **Submersible Transformer Failure / Replacement Report**
Our Reference: **6638**

Dear Sir:

Further to the power interruption that occurred on May 18th, please find the results of our investigation enclosed herein.

Initial Observations & Action:

- A single phase feed 27.6kV S&C fuse was found to have operated in the Eurasia Pavilion substation. The affected feed supplied three (3) submersible transformer vaults.
- The blown link was replaced and tested.
- The associated lightning arrestor was also tested at 5kVDC and found to be acceptable for continued use.
- The feed was re-energised and the new fuse did not operate.
- The 3 individual submersible vaults were subsequently inspected.
- The transformer adjacent to the "Bird Barn" was found to not be supplying power.
- After confirming that voltage was indeed present at the cable termination point to the transformer, the feed was isolated and the transformer tested.

Transformer Test Results:

- Insulation resistance ("Megger") testing of the transformer 240V secondary winding resulted in a less than acceptable reading ≅ 3.5MΩ. Industry standards require a minimum value of 100MΩ for this type of unit.
- Dissipation factor readings measured beyond the readable scale of the test set.
- High capacitance readings on the secondary winding confirmed this as the point of failure.
- Sampling of the transformer oil immediately gave evidence of internal failure by the oil's black/ yellow colour (due to carbonisation).
- The dielectric breakdown of the oil was laboratory tested at 18.6kV – a clear failure by any accepted standard.

Black & McDonald

Technical Field Service Division
31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Remedial Action Taken:

- As a result of the clear failure of the existing submersible transformer, it was removed from service.
- A new, compatible unit was sourced, supplied, tested, and installed.
- The failed transformer was removed from site and is being evaluated for repair or replacement.
- The old unit has been confirmed as being PCB-free.

I trust that this report will meet your requirements. We thank you for this service opportunity and invite any questions you may have. If there are any further concerns, please do not hesitate to contact the undersigned or Fred Tanguay (Tech. Service Manager) at any time.

Regards,
BLACK & McDONALD LIMITED

R.P. (Rodger) Morgan
Utility Technical Field Services

Black & McDonald

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Metro Toronto Zoo	**Date**	May 18, 1999
File Number	6638	**Tested By**	R. Morgan
Location	Scarborough, Ontario		
Equipment I.D.	Submersible Transformer (Old Unit)		
Substation	Bird Barn Submersible Vault		

Power Transformer -Electrical

Nameplate Data

Manufacturer	Westinghouse		**Vector Group**	240/ 120 Centre Tapped			
Type	ONAN		**Serial #.**	861942			
Neutral	Solid Ground		**Liquid Type/Vol**	Oil	38		**Gal**
Rating	100	**kVA**	**Total Weight**	1,300			**lbs.**
Impedance	1.8	**%**	**Primary Voltage**	16			**kVolt**
Phase	1	**ϕ**	**Secondary Voltage**	240/ 120			**Volt**
Frequency	60	**Hz**	**BIL**	125			**kVolt**

Insulation Tests

Insulation Resistance @ 5k / 500 VDC	**Prim. With Sec. Grounded**	**Sec. With Prim. Grounded**	**Prim. & Sec. To Ground**
MΩ	87,000	3.46	65,500
Corrected to 20 °C.			

	CH-L + G	**CH-G**	**CH-L**	**CL-G**	**CL-H + G**
Cap (pF)	122	117	4	3006	3000
Corr. 20 °C					
Dis. Fact.(%)	11.22	13.00	--	>39.99	>39.99
Corr. 20 °C.					

Turns Ratio Tests

Tap	**Primary Volts**	**Calculated Ratio**	**X0-X2 H1-H2**	**X0-X3 H2-H3**	**X0-X1 H3-H1**
1					
2					
3					
4					
5					

Tap Position Found & Left	
Results Satisfactory	NO

T.S.