City of Thunder Bay
Centennial Botanical Conservatory
Plant Assessment Report

July 2017

CONSERVATORY PLANT ASSESSMENT REPORT

In June of 2017, a horticultural assessment was undertaken of the existing tropical and cacti plant material in the City of Thunder Bay's Centennial Botanical Conservatory (CBC). The CBC was conceived by the Fort William Board of Parks Management as a centennial project to commemorate Canada's 100th birthday in 1967 and opened in 1968. The CBC was designed by Lord & Burnham, a renowned greenhouse manufacturer and builder of major public conservatories throughout North America.

The Conservatory is a 932 m^2 indoor tropical plant display which includes a tropical plant collection, a water feature, walking paths, a bridge, and two wings, with the west wing housing the cacti collection, while the east wing was once home to a seasonal display, however is no longer used for that purpose.

The Conservatory has provided a place of tropical refuge year-round. The residents of, and visitors to the City of Thunder Bay have enjoyed the tropical oasis through many winters thanks to this rare and lush, colourful and tropical indoor space as noted by the comments in the visitor's book.

Based on feedback from public and stakeholder consultations, the facility has served the community well and there is clear direction by the public that the facility should continue to do so, perhaps with some updates that could expand user space, activities and events. This year as Canada celebrates Canada150, the City of Thunder Bay is prudently undertaking an assessment of the Conservatory structure and with that is respectfully undertaking a plant assessment to inform the design of the facility/space in future.

Plant Assessment Process

The initial on-site horticultural assessment was undertaken by horticultural consultants from Green Design Landscaping Inc. and Kernow Gardens Inc. from June 8-11, 2017. Three hundred seventy one (371) significant tropical plants, two hundred and eighty-eight (288) cacti and succulent plants and numerous individual floor, wall and hanging plants were assessed.

The assessment recorded the following information:

- Plant Identification;
- Inventory and number assignment;
- Size and evaluation in terms of current health condition, significance, life expectancy/viability, and recommendations for transplant, re-propagation, protection, overbuild and / or disposal (to support transition and future facility).
- In addition, several hundred, notable understory (U/S) plants worthy of transplant or re-propagation were noted in each bed area.

All data and information collected was recorded for future use by the City of Thunder Bay. A copy of the detailed Plant Assessment and Inventory for the Tropical House is provided in Appendix A, and the Cactus and Succulent House is provided in Appendix B.

Observations

Initial observations of the plant collections and the facility are positive and the CBC staff should be applauded for work well done. The plants in the Tropical House and the Cacti and Succulent House, although mature in terms of specimen and canopy cover is incredibly lush considering age. At the time of assessment, the collection was noted as somewhat irreplaceable in terms of maturity for many of the original specimens. The collection is of economic and community value, however would not be considered a planting of unique horticultural significance at this time in terms of the rarity of the plants. Having said that, the City of Thunder Bay and visitors to the CBC are very fortunate to have such a gem in their community!

Considering the age of the facility and the level of technology supporting operational and environmental controls, it is the opinion of the consultants that the CBC has served Thunder Bay well. The plant collections identified in the Needs Assessment Consultation Report are important as they provide significant community value in terms of providing a place for connection with community and nature, as well as a space that has provided many memories of significant life moments including school trips, family excursions, weddings, memorial plants, donations, photo moments and multiple passive use opportunities. In addition, the community identified their connection with the edible and ornamental plants as important in terms of education and nostalgic connection with their ancestry. The users of the space as observed during our site assessment visit in June were of all ages, abilities and represented diverse cultures.

The structure of the Conservatory is of notable historical significance and should be researched and evaluated to determine structural viability, life expectancy and restoration opportunities. The profile and silhouette provide a unique and elegant feature to the Thunder Bay and Botanical community.

The plants and growing media are showing their age, which was confirmed by a third-party laboratory; SGS Canada Inc. based on samples taken on June 9, 2017. Samples were taken from Bed areas 2, 3 and 8, in the tropical house and the garden bed in the cactus house. Growing media sample locations were selected based on plant performance. Bed areas 2, 3 and 8 are home to more of the unique, mature and likely original specimens, and in some cases exhibited higher levels of pest population and lower levels of overall performance. The samples were selected to verify overall health of the growing media and to identify opportunities for rejuvenation.

Results are found in the detailed report provided in Appendix C, and Appendix C1, and are summarized as follows:

- pH of the samples taken from the tropical house were within an acceptable range
- pH of the sample taken from the Cactus and Succulent House was slightly high at 7.29
- All macronutrients (Nitrogen, Phosphorous, Potassium, Calcium and Magnesium) were low

- Sulphate reading in the Cactus and Succulent House exceeds the acceptable and optimal ranges
- Micronutrients were generally acceptable with the exception of Zinc and Manganese in all bed areas.
- Iron exceeds the optimum range
- Molybdenum in the Cactus and Succulent House slightly exceeded the optimum range.

In general, these results are not unexpected considering the maturity level of the growing media and plant material and based on the typically alkaline irrigation water supply in this region. The current growing media does not require removal, however requires a growing media leaching/flushing program that will re-balance it to an optimal range. Supplementation of the growing media should be undertaken on a regular and rotational basis based on plant performance and compaction levels. Following the leaching/ flushing program, the ideal macro and micro nutrients will be restored and maintained by development of a nutrient plan specific to the plant material and season. The established and responsive nutrient plan will ultimately be supported by the introduction of an automatic watering and fertilization system. Certain products perform better in some environments than others, and thus nutrient product selection, scheduling and application will be key to success.

Soil moisture in the tropical house was sufficient while the media moisture in the Cactus and Succulent House was observed as less than ideal at the time of assessment.

Irrigation water was also tested and analyzed. The indicator sample was taken from hose bib in Bed Area #1 as a representative sample to identify any concerns with the water supply. The water supply used for plant material throughout the Conservatory (Tropical/Cacti and Succulent and Seasonal houses), is non-potable as identified at source. Results from the third-party laboratory; SGS Canada Inc., indicate a high pH typical to the region, however no anomalies were noted. A copy of the laboratory report is provided in Appendix D.

Generally, plants are in reasonable to good condition, albeit many are mature and require horticultural and corrective pruning to restore health and structure. Most of the existing plant material can be transplanted and / or transplanted and re-propagated. As at June 11, 2017, there were nine (9) tropical plants identified for immediate disposal which are identified in Appendix E due to poor form, pest infestation and / or disease beyond control, in which case we do not recommend such plants be re-propagated. Special care in sanitization of tools, clothing and equipment during removal and disposal of these plants should be undertaken to prevent cross contamination. As of June 11, 2017, there are no cacti or succulents recommended for disposal.

Numerous plants have been identified to be preserved to serve as stock plants for re-propagation of new plants provided pest and disease control and nutrient programs are implemented to restore vigour. An ongoing re-propagation program can provide a steady supply of replacement plants, and support plant/ seed and cutting exchange with other

Conservatory's to expand the plant collection diversity. Extra plant material can also support educational outreach and volunteer partner group sales and activities such as Friends of the Conservatory, Master Gardeners etc.

Recommendations

The following recommendations assume that the tropical display area will be renewed and updated. It is also assumed that the west and east wings will be rebuilt with the intention that the original iconic profile will be duplicated. Furthermore, and very important to the long term success of this facility, it is assumed that all environmental systems and controls will be updated with new conservatory and greenhouse technologies that support an optimal environment for the plant material and users including but not limited to: light, temperature, irrigation, air exchange, humidity, nutrition/fertilization, and accessibility etc.

Recommendations for Existing Plant Collections

1) Identify and align the CBC short term and long term plan with operating budget and budgetary guidelines.
2) Remove plants identified for immediate disposal. See Appendix E.
3) Develop and implement a short term planting plan and transitional re-propagation plan based on the new long term planting plan of the renewed and rebuilt areas of the facility. (To be prepared by a Landscape Architect and Horticulture Consultants, specializing in tropical plants and cacti).
4) Develop a Collections Policy & Procedure to maintain the integrity of the collections, to support biosecurity and to respect the memorial plant dedications and public plant donations. (To be prepared by Horticulture Consultant.) Current staff will be trained to maintain the established policy and procedure.
5) Develop the new facility design to integrate and leverage trusted and proven automatic operational technologies that will support the CBC in maximizing energy and labour efficiencies and user experience.
6) Develop the new planting plan to support the Collections Policy and Procedure and respects the identified themes and values such as edible, origin, medicinal, and function, to ensure that we have the right plant in the right place. (To be prepared by a Landscape Architect and Horticulture Consultants, specializing in tropical plants and cacti).

Future Re-design considerations:

a. The Tropical House collection should be designed with consideration of theme(s) and cultural plant requirements to enhance diversity, and interest.
b. Include interactive, themed and seasonal displays (plants of special interest and bi-monthly rotating displays throughout.
c. The Cactus and Succulent collection should be themed using the large open planting area for large species but include more groundcover species to increase interest and diversity.

d. The bench collections in the Cactus and Succulent Collection should include diverse smaller species (*Mammallaria*), in bench settings (plunged in sand, gravel mulch with glass sided benches).

7) Develop and implement a strategic growing media renewal program based on a Master Planting Plan, and to support healthy plant life as required by collections. (To be prepared by Horticulture Consultant). It is not necessary to remove current growing media if the following actions are taken:
   - Plan and implement a growing media leaching/flushing program to re-balance to an optimal range.
   - Supplement the existing growing media on a regular and rotational basis based on plant performance and compaction levels.
8) Develop and manage a responsive nutrient management program to restore and prepare plants for improved success immediately, during transition and in future. Attention to product selection, scheduling and application will be key to success. (To be prepared by Horticulture Consultant).
9) Develop and implement a customized Integrated Pest Management Plan that includes strategic media and nutrient management best practices and biological pest control. (To be prepared by Horticulture Consultant).
10) Control/restrict identified invasive plants by transplanting into closed containers and then direct planting into bed areas to provide desired coverage.
11) Develop a strategic Re-propagation Plan as prescribed in the Plant Assessment Matrices provided in Appendix A and B, and to support next generation of existing plant material in renewed and rebuilt spaces. The plant collection currently holds many duplicates. Propagation of duplicates should cease until a direction is finalized (To be prepared by Horticulture Consultant).
12) Upon completion of the facility renewal and re-build, plan for a dedicated production greenhouse to support the tropical, cacti and succulent houses and plant renewal/seasonal display to reduce plant replacement and new introduction costs.
13) Rotate collections for seasonal interest. Introduce plants as per plan and specific themed collections to expand diversity and reduce over re-production of certain plants. (i.e. too many Holly Ferns/Jade plants etc.) To be prepared/supported by Horticulture Consultant).
14) Develop labelling, interpretation and communication policy and procedures to enhance visitor education and experience. (To be prepared/supported by Horticulture Consultant).
15) Build relationships with other public gardens, conservatories, universities and colleges, to increase plant diversity at minimal to no cost for young stock.

Facility and Site Recommendations

1) Remove the existing cedar trees located at the front of the conservatory to increase air circulation.
2) Develop and Design the facility renewal and re-build plan to:
    a) Provide for spatial requirements of the new planting plan, the users, and sufficient workspace for staff and community partners.
    b) Design and procure materials that are conducive to creating a safe space for staff and visitors. (Non-slip floors, positive grades and drainage to reduce water pooling etc.).
    c) Support a healthy and safe work environment (consideration for Working from heights, slips trips and falls, working alone, musculoskeletal disorders, violence and harassment exposure etc.
    d) Incorporate and create awareness around Green Energy and environmentally sustainable best practices as a demonstration model to the community.
    e) Invest in new glass material to enhance community visibility, enhance light transmission and to eliminate labour intensive need to whitewash glass panes.
    f) Integrate and leverage trusted and proven automatic climate controls and operational technologies to maximize energy and labour efficiencies, and enhance user experience.
    g) Update environmental climate and operation controls to support the Green Energy Plan and leverage proven automated technology to reduce operational, and provide ideal control mechanisms for temperature, shading, air circulation (fans and venting), humidity, light transmission, supplementary lighting, irrigation etc.
3) Assign sufficient Capital Budget for the facility renewal and re-build phases and align with long term Operating Budgets to ensure long term success.
4) Develop community awareness strategy that includes investment in presenting the Conservatory to residents, educators and tourists as a year round destination/ attraction. Consideration should be given to city wide way-finding signage and on site signage etc.
5) Maintain and develop partnerships with the Friends of the Conservatory and local garden clubs, Horticultural Societies, Master Gardeners, schools, college and university programs, Community service providers to engage and explore next generation opportunities.

Interim Transitional Holding/Growing Requirements

The following recommendations assume that the current and/or the proposed new production houses used by the City of Thunder Bay to support internal plant production requirements could potentially support the plants as a hold-over facility during the transition with some strategic and logistical coordination.

It is noted that the transition is anticipated to be less of a burden in terms of labour and operations if initiated once the new production greenhouses are installed as it is assumed that all environmental systems and controls will be updated with new but proven automated greenhouse production and climate control technologies that support efficient operations for both staff, production and temporary transitional requirements.

It is anticipated that the new production house(s) will be designed with automated production in mind and include but not be limited to the following: automated rolling benches, seeding and potting machines and automated climate control, irrigation, nutrition/fertilization. This investment is expected to support and advance the transitional Holding and Growing Requirements.

Interim transitional holding requirements for the plant material will also depend on the time of year, duration of transition requirement, weather, space, and health of plant material at the time of renewal or re-build.

It is important to initiate an ongoing re-propagation program as mentioned in the short term to ensure that the legacy of the original planting is carried on genetically. The Assessment report identifies whether an existing plant should be Transplanted (T), Re-propagated (RE), Protection (P), Overbuild (O), and Disposal (D). It should be noted that no plants were identified that require overbuild or protection, however most plants were recommended to be either, or a combination of Transplant and/or Re-propagation. The transplant and re-propagation plan should conform to the proposed Planting Plan and Plant Collection Policy in order to guide the future development of the collection.

Most plants were suggested for re-propagation for the following reasons:

- Maintain genetics,
- Reduce plant replacements,
- Support the current community connection,
- Provide contingency in case plants fail during transition,
- Support potential partner entrepreneurial opportunities,
- Support education, curriculum and community programs.

It is important to note that transplanting of plant material should be overseen by Certified Interior Landscape Horticulturists (or equivalent), and would occur by hand, and/or machine, while larger specimens will require transplant by tree spade.

The minimum amount of space required for the transitional holding facility is projected at approximately 2500-3000 m^2 to allow for growth, quarantine (biosecurity), and to support strategic acclimation and horticultural care to prepare plants for their renewed / re-built home. Many of the original specimens will require height reduction to fit in the production greenhouse, which if drastic may compromise them, however this could be resolved by the strategic re-propagation plan that should be well underway. In addition, it will be important to incorporate new specimens in the new facility to provide increased diversity (as per the recommended planting plan) and also to create some new interest. Using the production houses as the interim transitional holding facility could be the most cost-effective solution and simpler in terms of the environmental and maintenance infrastructure required to undertake this step well and without concern for weather and timelines etc.

Alternatively, a taller 25'/ 7.6m tall temporary shade house type structure/ poly house could be constructed on site or rental of an industrial warehouse to support plant material as a temporary solution if required, however this will require investment in infrastructure to the area which could include the need for grading and drainage, supplemental lighting, stability for grow pots and canopy (blocks and ties to maintain upright), irrigation water and system, temperature and climate control etc. Such a facility may be re-usable after the build for other production requirements.

Regardless of the transitional facility, the following conditions will need to be provided to support best success:

- Spatial requirements: 2500-3000 m^2 is recommended to allow for quarantine, horticulture procedures and maintenance including pest control
- Light:
    - 1000 fc minimum for maintenance and rejuvenation of existing plant material
    - 2000-5000 fc to support re-propagation plan
- Soil/media: Maintain native media and implement a strategic nutrient and amendment renewal program to support long term success.
- Watering regime- ideally an irrigation system- drip line or bubblers
- Temperature and air circulation regulation: 18-25C
- Humidity: 50-70%

Staff Capacity & Development

The following recommendations assume that the current and/or the proposed new production houses used by the City of Thunder Bay to support internal plant production requirements could potentially support the display plant material as identified for transition as a hold-over facility during the transition with some strategic and logistical coordination.

There is a current staff complement of four (4) full time staff assigned to the production greenhouses and the public tropical and cacti houses/ display areas. It is anticipated and based on current knowledge, that this staff complement would be sufficient to support the new production houses and newly identified city wide plant requirements along with the maintenance of the display area plant material if they have the required horticultural knowledge and skills and/or direction.

With the amount of change anticipated, it is prudent of the City of Thunder Bay to support professional development/training opportunities for the CBC supervisory staff, to support the long- term preservation of the current and future interior landscape asset, and provide focus on horticulture best practices and standards for growing, installing, and maintaining diverse collections of edible and ornamental tropical plants, cacti and succulents, and the city wide plants required.

Immediately it will be important to provide training on the completed plant assessment digital data base and record of the current collection and inventory and how this tool can support the staff and how to maintain these important records going forward. The City invested significantly to undertake this inventory and it is recommended that it be maintained and evolved as required.

It is expected that the current staff team will require additional technical training and/or support to undertake the transitional recommendations as per recommendations above once the display areas are renewed/re-built. The current staff team will require training and oversight to become skilled at operations of the new facilities and automation processes and technologies, however it is anticipated that they will do well based on their current skill set if the appropriate training is provided. It is recommended that current job descriptions be reviewed and additional experience or education in terms of horticultural production, interior landscaping, cacti and outdoor plants be required.

It should be noted that is it anticipated that the staff will benefit from training to achieve the recommended competencies outlined above. There are several horticultural trade associations that host professional development programs and events located nearby in Ontario, Winnipeg and Minnesota that can support training plans. Several post-secondary programs also host night classes and on-line courses as well that may be beneficial.

It may be advantageous to gain expertise from Horticulture Consultants from time to time as identified in the recommendations above and to bridge gaps throughout the transition and establishment of the display and plants in their new home.

Conclusion

The Centennial Botanical Conservatory in Thunder Bay is a unique infrastructure asset that is not well known, but has great potential to serve the community for years to come. Over the last fifty years, the CBC's design of the interior and exterior landscape has changed and adapted. Use has definitely changed within that time frame as well.

Although this assessment identified no plants as unique or of particular horticultural significance, it is clear that this collection, in its entirety, holds great value to the community. The cost to replace plants in the tropical house alone, with juvenile sized plant material is projected to be over $1 million (fluctuating with U.S. exchange rate). In terms of appraised replacement value, at their current size and maturity, the cost to replace the existing tropical plants could represent a $2-$5 million investment.

It is apparent that this facility is very important to the community and it is known that green infrastructure is instrumental in providing health and wellness benefits to users. As many expressed in the public consultation, it is important that this facility, or one like it, with expanded use and space, continue to serve Thunder Bay as a garden and tourism, and health and wellness destination.

The City of Thunder Bay is applauded for its progressive thinking in undertaking this assessment and exploring opportunities and solutions that are relevant to the community and are sustainable in the future. This forward- thinking approach will enable the community to enjoy and use this space for years to come, and make it a relevant city landmark through to Canada's 200th birthday.

Respectfully Submitted by:
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