



**SUGARWORLD WATER PARK
WATERSLIDES CONDITION ASSESSMENT**

REPORT NO. 10485_1

April 2010

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APPENDICES

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EXECUTIVE SUMMARY

This report presents the findings of a condition assessment inspection carried out on the Sugarworld Water Slides located at Edmonton.

The facility was found to be in a dilapidated state as follows:

- Major cracking of the fibreglass tubing at locations
- Major deformation of the fibreglass tubing at locations
- Severely corroded support steelwork framing

The facility is approximately 35 years and nearing the end of its useful life. The report sets out several options for Council to consider for continued safe operation of the facility:

1. Full replacement of tubes and support steelwork
2. Refurbishment only of tubes and support steelwork
3. Replacement of tubes only and refurbishment of support steelwork
4. Purchase second hand slides and close down existing. Note the existing location would not be appropriate for these slides as they are a totally different configuration.

A summary of costs are presented below:

<i>OPTION</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
PRICE (excl GST)	\$3,440,000	\$2,192,000	\$3,153,000	\$2,231,000

It is imperative that Council undertake replacement or remedial works as a matter of priority as there is potential for injury to the public using the slides if this work is not carried out. Moreover, Council will need to consider the cost of undertaking the reconditioning works versus the cost of replacing the tubes with new fibreglass tubes acknowledging that the asset is nearing the end of its useful life.

In conclusion catastrophic failure of components of the slide cannot be ruled out and accordingly it is recommended that Council close the slides until such time as they are replaced or remediated.

1 INTRODUCTION

PDR Engineers was engaged by Cairns Regional Council (CRC) to undertake a condition assessment on the Waterslides of the Sugarworld Water Park, Cairns. The objectives of the investigations were to:

- i) Establish the present condition of the slides
- ii) Establish the present condition of the steelwork supporting the slides
- iii) Make recommendations of the repairs required to bring the slides into improved serviceable condition

This report details the findings of the investigation, conclusions, recommendations and repairs and/or upgrade requirements.

2 BACKGROUND

The Sugarworld Waterslides were first built and located in the Cairns City. In 1989 the slides were dismantled and reerected in their current location at Edmonton, 16km south of the Cairns City, QLD. The waterslides are approximately 35 years old and are open to the public on weekends and most public holidays.



Figure 1: Sugarworld water Park Current Site Location

(Source: www.sugarworld.com.au/contact.html, 10/03/2010)

The Sugarworld Water Park consists of four (4) waterslides - The Cyclone, Sugar Glider, Banana Bender and Flying Fox ranging in difficulty level.

An inspection was performed by PDR Engineers on 10 November and 15 December 2006. The inspection report 'Sugarworld Waterslides – Structural Dilapidation Report', dated 20 December 2006, was issued to CRC following the above inspections. This report recommended the following actions:

1. *Repairs as outlined in sections 4.1 to 4.4 of the report.*
2. *Repair/replacement of the corroded steel framing members and connections.*
3. *Further examination of the fibreglass tubing, flange joints and steel frame for signs of disrepair and to undertake repairs/replacement as necessary during the refurbishment process.*

No drawings were available for review at time of inspection for both the waterslides tubing and the steel frame structures.

3 SCOPE OF WORKS

The scope of this investigation by PDR Engineers includes the following:

1. Assess the current condition of the waterslides – The Cyclone, Sugar Glider, Banana Bender and Flying Fox.
2. Identify any significant defects which could adversely affect the structural performance and serviceability.
3. Provide conclusions and recommendations including any potential maintenance or repair work to prolong the life of the waterslides.

4 METHODOLOGY

4.1 Personnel

A site inspection was carried out on Saturday, 6 March 2010, by:

- Boipuso Samuel,, PDR Engineers,

accompanied by Danny Hourn of Sugarworld Water Park (Life Guard).

4.2 Access

At time of inspection, the waterslides were not operational, and our inspection commenced two (2) hours before opening of the Sugarworld Water Park facility.

There were a number of access restrictions around the exterior of the three waterslides - Sugar Glider and Flying Fox. This was mainly due to the existing overgrown trees and shrubs to the sides of the waterslides tubing. Access to the wall exterior of the Cyclone waterslide tubing was available by navigating through the existing trees and shrubs.

The interior of The Cyclone and Sugar Glider slides was visually inspected by walking through the tubing.

4.3 Investigation procedures

A visual inspection was carried out noting all relevant defects and features, photographs were taken to document the condition of both the waterslides and the steelwork supporting the slides fibreglass tubes. Refer also photos in Appendix A.

4.3.1 Structural steel framing support members

The steelwork frame supporting the waterslides tubing was visually inspected to assess its current condition.

4.3.2 Fibreglass tubing flange joints

Visual inspection to flange joints of the waterslides was also carried out to identify current integrity of the tubing structure.

4.3.3 Fibreglass tubing

The interior and exterior of both The Cyclone and Sugar Glider waterslides tubing was inspected visually to check areas around the tubing to assess its current condition.

No destructive testing was undertaken at time of inspection to the above elements.

5 VISUAL INSPECTION FINDINGS

A visual inspection was undertaken on the waterslides and the following is our findings from the inspection:

5.1 Structural steel framing support members

- Steelwork and connections show severe corrosion in some areas due to chlorinated water leakage from the tube flange joints. There are a number of locations where steelwork and connections are in a dilapidated state. The corrosion is typical of painted steelwork exposed to chlorinated water.
- One location of the steel frame shows a hole through the steelwork due to severely corroded steel joint.
- The concrete footings supporting the steelwork do not show any signs of movement or settlement.

5.2 Fibreglass tubing flange joints

- Wearing to joint sealant or waterproofing material on the inside of the tubing flange joints in a few locations.
- Visible gaps up to 10mm at flange joints along the tubing due to wearing joint sealant, hence water leakages at flange joints.
- Visible patching to most of the flange joints indicating newly sealed joints.

- Noted some nuts/bolts missing to vertical flange joints (Photo 11).
- The tubing flange joints have cracked, delaminated or buckled in a few locations of the slides.
- Visible buckled horizontal tubing flanges due load concentration between the steel support points and the tubing flanges.

5.3 Fibreglass tubing

- Visible loss of paint to exterior of the tubing in a number of locations of the waterslides
- One section of the tubing showed fibreglass wear to bottom interior of the Sugar Glider waterslide showing bouncy effect when walked across
- Visible random patching to the interior of the tubing of the inspected slides (Photo 14 & 15).
- Visible bowing or buckling to some of the tubing walls due to overgrowing tree branches (Photo 16).
- Bowing to bottom of tubing due to tree roots.
- Missing air vents covers to top of tubing in few locations.
- Glass fibre exposure to most areas indicating loss or wear of the external gel coat.

6 RECOMMENDATIONS

The waterslides currently located at Sugarworld Water Park, Edmonton, were originally built and located in Cairns City around 1975.

The four waterslides – The Cyclone, Sugar Glider, Banana Bender and Flying Fox are currently in use by the public. However, following our inspection of 6 March 2010, we recommend that the following be addressed as a matter of urgency as some of the waterslides elements are in a dilapidated state. Refer also photos in Appendix A.

6.1 Structural steel framing support members

Engage a specialist steel fabricator to undertake the following:

- Dismantle and/or repair all the severely corroded steel work
- Re-fabricate the repaired steelwork
- Repaint all the repaired steelwork with a high durability paint system
- Provide an alternative saddled support system for the tubing to eliminate buckling of horizontal flange joints at support points.

6.2 Fibreglass tubing flange joints

Engage a specialist fibreglass repairer or manufacturer to undertake the following:

- Re-seal of all flanged joints that show leakage or gaps
- Remove and replace joint sealant that is deteriorated and apply flexible water tight joint sealant
- Install missing bolts and nuts to flange joints
- Repair all tubing flange joints that shows cracking, delaminating or buckling. Steel clamp plates may need to be installed to provide additional support.

6.3 Fibreglass tubing

Engage a specialist fibreglass repairer or manufacturer to undertake the following:

- All the current repairs to the interior of the fibreglass tubing to be checked for their integrity.
- Re-condition all the tubing interior of the waterslides following the above, which will involve re-fibre glassing plus gel coat.
- Re-painting of all the exterior of the waterslides tubing

- Replace entire tubing for sections that cannot be adequately repaired. Note this action might require the waterslide in repair to be closed during the tube moulding and replacement.
- Undertake tree logging to branches lying on sections of the waterslide and on the ground adjacent to the waterslides

In addition to the above repairs, we recommend that the following be undertaken immediately.

- Engage site maintenance personnel to inspect the tubing interior on a regular and daily basis for any sharp or rough edges which may occur due to cracking or splitting of the fibreglass. It is recommended that inspections be undertaken prior to the facility opening for every day of operation.
- If the above defects are identified, the waterslides shall be closed until the repair work is undertaken to bring the slides to a serviceable condition.

We also recommend that a qualified structural engineer be engaged to undertake thorough assessment of the existing steelwork, and to provide details and specification of repair work required.

A specialist fibreglass repairer or manufacturer will first need to be engaged prior to undertaking the above work to further inspect the waterslides, and determine the amount of repair work required for quoting of the works.

We note that re-conditioning of the waterslides will require closing the slides in pairs (ie closing The Cyclone and Sugar Glider waterslides and using the Banana Bender and Flying Fox waterslides or vice versa).

In summary, it is imperative that Council undertake these works as a matter of priority as there is potential for injury to the public using the slides if this work is not carried out. Moreover, Council will need to consider the cost of undertaking the reconditioning works versus the cost of replacing the tubes with new fibreglass tubes acknowledging that the asset is nearing the end of its useful life. It is envisaged that tube replacement cost will be far in excess of refurbishment costs, however refurbishing may only achieve a limited life extension.

7 COSTINGS ON OPTIONS FOR REPLACEMENT AND REMEDIATION

Several indicative cost estimates were performed by Davis Langdon Quantity Surveyors under our instruction as follows:

1. Full replacement of tubes and support steelwork
2. Refurbishment only of tubes and support steelwork
3. Replacement of tubes only and refurbishment of support steelwork. Note the existing location is not appropriate for these tubes as they are a totally different configuration.

A summary of costs are presented below with a fourth option which is to purchase second hand slides and close down the existing.

<i>OPTION</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
PRICE (excl GST)	\$3,440,000	\$2,192,000	\$3,153,000	\$2,231,000

8 CONCLUSION

It is imperative that Council undertake these works as a matter of priority as there is potential for injury to the public using the slides if this work is not carried out. Moreover, Council will need to consider the cost of undertaking the reconditioning works versus the cost of replacing the tubes with new fibreglass tubes acknowledging that the asset is nearing the end of its useful life.

In conclusion catastrophic failure of components of the slide cannot be ruled out and accordingly it is recommended that Council close the slides until such time as they are replaced or remediated.



Appendix A

Inspection Photos



1. Sugar Glider & The Cyclone Waterslides



2. Banana Bender and Flying Fox Waterslides



3. Open air vents to top of tubing



4. Holes to top of tubing at missing lights



5. Vertical tubing flange joints buckling



6. Flange joints cracking and buckling at support locations



7. Severely rusted steelwork for The Cyclone waterslide



8. Corroded steel tubes for The Cyclone waterslide



9. Corroded steel frame supporting tubes for The Cyclone waterslide



10. Steelwork rusting to Flying Fox waterslides



11. Missing bolt nut



12. View of supported Banana Bender tubing



13. Cosmetic delamination of paint finishes near waterslides entry



14. Patching to tubing walls



15. Patching to tubing walls



16. Inward bowing of the tubing due to overgrown tree