Container Baler Upgrade & Monitoring Results
CIF Project # 271

April 2012

Prepared by:

Mary Little Tel: 905-372-4994,
Email: mary@2cg.ca

This Project has been delivered with the assistance of Waste Diversion Ontario's Continuous Improvement Fund, a fund financed by Ontario municipalities and stewards of blue box waste in Ontario. Notwithstanding this support, the views expressed are the views of the author(s), and Waste Diversion Ontario and Stewardship Ontario accept no responsibility for these views. *© 2011 Waste Diversion Ontario and Stewardship Ontario*

All rights reserved. No part of this publication may be reproduced, recorded or transmitted in any form or by any means, electronic, mechanical, photographic, sound, magnetic or other, without advance written permission from the owner.

Executive Summary

This report outlines the monitoring results of the most recently funded equipment installation of the new container baler; NEXGEN Galaxy Dual Ram.

The return on capital investment is 3.3 years with CIF funding.

The County of Northumberland has seen an increase in baling efficiency by an annual savings of $70,600 per year. This has been achieved by averaging 67% faster bale times, increasing average bale densities by up to 71% and a reduction in downtime.

The Northumberland MRF was built in 1996 and is located in Grafton ON, situated along the 401 corridor approximately 1.5 hours east of the Region of Durham and 1 hour west of Quinte Region and 1 hour south of the City of Peterborough. The facility currently manages 15,380 tonnes per annum (TPA), 60 tonnes per day (TPD).

The facility has a province wide Certificate of Approval (C of A) and is licensed to receive 350 tonnes per day of blue box material.

To improve overall processing performance and reduce operating costs, the Northumberland MRF has conducted the following capital improvements over a 4 year planning period:

- Installation of a new drum feeder (2009-E&E funded);
- Installation of a new triple deck fibre screen system (2009-E&E funded);
- Installation of a new fibre sort line equipped with optical sort technology (2009-not funded);
- ESCO Study (2010-CIF funded)
- Installation of a new container baler and supporting metal infeed conveyor (2011-CIF funded);
- Installation of a new fibre baler (2012-not funded); and,
- Purchase of new rolling stock inclusive of skid steer and forklift (2012-not funded).

Table of Contents

1.0 Introduction

County of Northumberland (County) retained 2cg Inc. (2cg) to document the System Operations and Monitoring of the newly purchased baler for the container sort line, CIF project #271. This monitoring report provides pre installation data of the original container baler inclusive of bale densities, performance levels and related operational costs associated with the baler. Upon commissioning of the newly installed baler comparative data was collected to determine the overall effectiveness of the new baler. The timeframe for this Project spans from late 2010 (pre installation) to early 2012 (post installation).

2.0 Program Background

The County of Northumberland has committed to operating the Material Recovery Facility. As a result, capital equipment replacement reserves are included within the annual budget.

In 2011, the County received 2.1 million in material sales representing an average composite index of $170 per tonne of marketed material, reflecting comparable revenue with the 2011 provincial composite index of $169/tonne. The Net annual operating cost of the Northumberland MRF in 2011 was $100/tonne.

The reported population for the County of Northumberland is 83,043 (37,000 h.h.). The geographic area of the County is approximately 3,000 square kilometers composed of a mix of urban and rural areas.

Figure 1 Area Map depicting location of the County of Northumberland

The publically owned and operated Northumberland MRF is a 55,000 sq. ft. single stream facility that is currently processing approximately 15,380 tonnes per year (60 tonnes per operating day) on a single shift. The facility manages a broad spectrum of plastics inclusive of film plastic and all rigid container grades. The MRF (C of A A311713) is licensed to receive material from the province with a maximum inbound limit of 350 tonnes per operating day (260 days per year).

Blue Box processing services provided by the County (March 2012) include;

- Single Stream processing of residential and IC&I sector blue box material throughout the County;
- Two stream processing of City of Kawartha Lakes blue box material; and
- Direct bale processing of dedicated loads of fibre from private contractors.

Photo 1 depicts the County of Northumberland MRF.

Photo 1 – County of Northumberland Material Recycling Facility- Grafton, ON

3.0 Project Description and Objectives

The original container baler (5042 American-purchased 1991) required continuous maintenance and exceeded its operating effectiveness. Within the past 5 years, the baler experienced annual maintenance cost of $25,000/year. The associated additional staffing costs related to the baling operations equate to $28,000 per year and the lighter payloads of plastic material (less than 40,000 lbs. per load) are estimated to account for a further $17,000 per year in lost revenues representing an overall annual cost of close to $70,000 per year. A budget of approximately $113,000 would have been needed to fully refurbish the 20 year old baler based on the overall wear of the floor, walls, expansion chamber, infeed conveyor, ram and cylinder.

In addition to the high operating costs to maintain the aged container baler, the

County experienced limited processing capacity of the inbound container material due to the slower bale cycling times and bale breakages resulting in re-baling of plastic material.

Photo 2- 1991 American Baler 5042

The County released a tender # 41-10 requesting pricing to remove the original baler, install a new baler and supporting infeed conveyor with specifications for a metal conveyor system. The County received three bid submissions and awarded the contract to Metro Compactor Services for a Marathon, Nexgen 2R250N 100 HP dual ram baler equipped with 84" hopper infeed opening, touch screen controls and diagnostic bale functions. Refer to baler specification sheet in Appendix 1.

Photos 3 and 4 depict the newly installed container baler.

Photo 3- Nexgen 2R250N

Photo 4- Programmable Control Panel

The full price (purchase and install) of the baler and metal infeed conveyor was $470,639 plus taxes, minus the trade-in value of the original baler ($25,000) for a

total price of $445,639. The breakdown of the component pricing is as follows:

- baler $330,639
- metal infeed conveyor $100,000,
- installation $15,000

Additional cost associated with electrical connection that was not covered by the installation was approximately $25,000.

Delivery timeframe was 16 weeks from point of order and installation timeframe was approximately 5 days. The majority of the installation time was devoted to the removal and assembly of the metal infeed conveyor (4 days). The old baler was removed in the afternoon of a Friday, installed on a regular plant shutdown day (Saturday) and was operating on Sunday. Staff training involved approximately a half a day of `classroom' health and safety training and two full days of operator training.

Staff anticipated that by replacing the existing baler with a new baler would achieve the following performances objectives;

- reduce downtime/maintenance costs,
- increase bale density,
- improve revenue from material sales, and
- increase overall container processing capacity.

Prior to the new baler installation, County staff recorded bale weights, timing and dimensions for container materials as a baseline.

4.0 Monitoring Results

Bale Weights

Bale weights were recorded in the fall (November & December) of 2011 from the original baler output to establish a baseline of information to compare with the March 2012 results from the new baler.

Table 4.1 depicts the pre and post installation Bale dimensions and densities comparisons for the original American 5042 baler and the newly installed Nexgen 2R250N baler. Bale densities for HDPE and Mixed Plastic experienced the greatest improvement with HDPE depicting 71% greater density with the new baler and Mixed Plastic depicting 64% greater density. PET bales preformed somewhat lower but still depicted 19% greater bale densities than during pre-installation.

Table 4.1 Pre Installation vs. Post Installation Bale Densities

Summary	Pre Baler Average Bale Density (Kg/ft3)	Post Baler Average Bale Density (Kg/ft3)	Overall Change in Bale Density
PET	9.71	11.54	**19%**
HDPE	7.79	13.35	**71%**
Mixed Plastics	8.6	14.11	**64%**
Aluminum	6.87	10.46	**52%**
Steel	13.52	18.61	**38%**

Bale dimensions recorded for the new baler depict smaller bale sizes but improved bale weights (densities). The improved bale densities result in heavier outbound loads for all material and improved payloads for material. The integrity of the plastic bales has eliminated the lost time associated with re-tying broken or loosely packed bales. Within a pre-installation operating year, it was estimated that the baler operator experienced close to 350 hours of non-productive baling time managing broken plastic bales.

Table 4.2 depicts the estimated time recorded by the baler operator during the pre-installation operating year to manage broken plastic bales.

Table 4.2 Pre Installation Lost Time Estimates

Activity	Estimated Hours per year	Cost per Hour	Total Cost
Non-Productive Baling Time	347	$32.59	$11,308.73

The smaller bale dimensions also allow for greater flexibility in bale storage on the MRF floor. Pre-installation plastic bales were stacked to the maximum of three bales per row. Post installation allows for four bales per row thereby improving floor space capacity for outbound storage of plastic material.

Weights

The improvement of bale weights resulted in greater outbound trailer weights. PET, HDPE and Mixed Plastic receive an additional 2.2 cents per kilogram for loads exceeding the 18,144 kilograms (40,000 pounds) threshold.

For baseline comparison purposes, Table 4.3 depicts the average bale weights and trailer loads for plastic materials during the pre and post installation period. It can be noted that with the original American 5042 Baler all outbound plastic loads did not meet the minimum threshold for additional revenue.

All plastic material loads with the new Marathon Nexgen Baler exceeded the minimum threshold and achieved the additional 2.2 cents per kilogram for material sold.

Table 4.3 Trailer Weights

Summary	Pre Baler Average Bale Weights (Kg)	Pre Baler Average Bales Per Trailer	Pre Baler Average Trailer Load (Kg)	Post Baler Average Bale Weights (Kg)	Post Baler Average Bales Per Trailer	Post Baler Average Trailer Load (Kg)
PET	335	52	17,423	564	43	24,089
HDPE	336	48	17,578	653	32	20,903
Mixed Plastics	403	44	17,791	644	32	20,600

During post-installation, the revenue received from the improved trailer weights represented an annual increase of $17,360 per year in plastic material sales.

Table 4.4 depicts the annual revenue gain from exceeding the minimum threshold of 18,144 kilograms per trailer load.

Table 4.4 Post Installation Annual Revenue Gain

Materials Shipped	2011 Tonnes	Additional Revenue (2.2 cents/Kg)
PET	408	$8,970
HDPE	215	$4,735
Mixed Plastics	166	$3,654
Total	789	$17,359

Details of overall container loads for both pre and post installation periods are depicted in Appendix 2.

Time Trials

Three separate time trials were conducted during the pre and post installation periods of the new container baler to analyze average baling production times for the container materials. Detailed results are depicted in Appendix 2.

In summary, average pre installation time to produce a bale (from point of load onto the infeed conveyor to tying off and exiting the baling chamber) was 16 minutes per bale. PET bales represented longer baling times (21 minutes), steel and aluminum depicted shorter baling times (12 minutes).

The average post installation time to produce a bale using the new baler was 5 minutes per bale. PET averaged 7 minutes per bale and steel and aluminum averaged 4 minutes per bale. The overall improvement to the baling times (production) depicted a reduction in baling time of up to 67% resulting in improved daily processing capacity at the facility.

Table 4.5 summarizes the average baling times from the three separate time trials of the pre and post installation periods.

Table 4.5 Summary of Baling Times

Baled Containers	Pre Install Average	Post Install Average	Average Bale Time Improvement
	Bale Time (Minutes)	Bale Time (Minutes)	(%)
Aluminum Cans	12.24	4.40	63.87
HDPE	16.46	5.23	68.12
Mixed Plastic	17.01	5.53	67.53
PET	21.82	7.19	67.02
Steel	13.54	4.21	68.92
Average	16.21	5.31	67.09

The gain in production throughput (baling time) eliminated the requirement of part time baling operations, representing a further savings of approximately $17,000 per year for a total staff savings of $28,300 per year. Table 4.6 depicts the annual savings in staffing costs (non-productive time and part time staff) as a result of the new baler installation.

Table 4.6 Operational Cost Savings

Activity	Estimated Hours per year	Cost per Hour	Annual Savings
Non-Productive Baling Time	347	$32.59	$11,308.73
Part-Time Baler Operator	830	$20.48	$16,998.40
Total			$28,307.13

8.0 Conclusions

The County of Northumberland has seen an increase in baling efficiency by an annual savings of $70,600 per year. This has been achieved by averaging 67% faster bale times, increasing average bale densities by up to 71% and a reduction in downtime.

The payback period for the capital investment of the new container baler for the County of Northumberland is 3.3 years.

Table 4.7 depicts a summary of the annual savings gained by the County as a result of the new baler installation.

Table 4.7 Summary of Annual Savings

Activity	Annual Savings
Non-Productive Baling Time	$ 11,308.00
Part-Time Baler Operator	$ 16,998.00
Additional Revenue	$ 17,359.00
Annual Baler Maintenance	$ 25,000.00
Annual Savings	**$ 70,665.00**

Table 4.8 summarizes the payback period including the financial assistance from CIF.

Table 4.8 Return on Investment (ROI)

Activity	Annual Savings
Baler	$ 330,639
Conveyor	$ 100,000
Installation	$ 15,000
Total Capital Investment	$ 445,639
CIF Funding	$ 213,205
Annual Savings	$ 70,665
ROI with CIF Funding (Years)	**3.3**

Appendix 1
Baler Specification Sheet


NARROW SERIES
GALAXY 2R®
TWO RAM BALERS
The GALAXY 2R - Two-Ram Balers feature a combination of the latest electronics technology and advanced structural engineering to make the most powerful and efficient balers available.
Featuring NexDoor®
NEXGEN
BALING SYSTEMS

GALAXY 2R® Two-Ram Balers Narrow Series

Basic Specifications:

	2R 150N	2R 190N	2R 250N
Available Power Unit	30 & 50	50 & 2x30	50 & 2x30
GPM	73 & 137	137 & 128	137 & 128
Average Cycle Time Sec.* (no load)	19.1 & 11.9	16.0 & 16.9	18.4 & 19.5
Compressing Cylinder (Bore x Rod x Stroke)	8" x 6" x 120"	9" x 6" x 133"	9" x 7" x 153"
Compressing Force (PSI)	150,800	190,850	254,470
Feed Opening (W x L)	40 3/4" x 57"	40 3/4" x 70"	40 3/4" x 84"
Baler Size (L x W x H)	28'-7" x 17'-6" x 44"	31'-6" x 17'-6" x 44"	35'-4" x 17'-6" x 48 1/2"
Height to Top of Hopper	92"	92"	92"

Features & Benefits

High-efficiency Power Unit – Power units available from 30 HP up to 2x30 HP; TEFC motors; flooded suction pumping system with high-flow hydraulic manifold; 10 micron filtration system; pressure and current transducers; separate cooling and tier circuit; and air-to-oil cooler.

Maestro® Color Touch-Screen Operator Interface PLC programmable controller features automatic and manual controls, diagnostics and bale set-up functions. Also available with multi-language option.

Factory Start-Ups

NEXGEN provides on-site start-up and comprehensive baler operation training for your personnel.

An optional Modem can be provided to allow factory diagnostics and trouble-shooting capability.

Adjustable Shear Beam – The body shear blades are adjustable from the exterior of the machine (optional on 2R150 & 190).

Laser Positioning – Main ram, ejector ram, and ***NexDoor®*** are controlled by a long range laser sensor. Tie positioning is determined by the laser and eliminates the need for a sprocketed counter wheel.

EZ-TRAX CONVEYORS

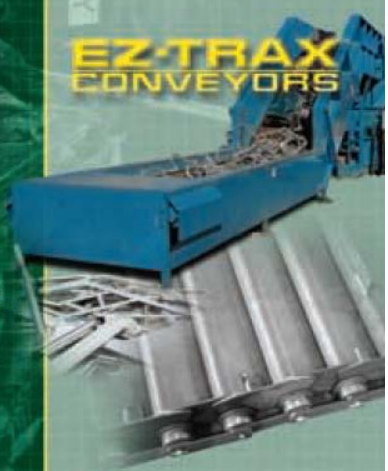
Shear Blades – Ram shear blade is replaceable and reversible. Body shear blade is serrated, adjustable, reversible, and replaceable.

Replaceable Liners – 500 brinell steel replaceable liners on floor, sides, and platens for superior wear resistance. Tongue & groove charge chamber floor (optional on 2R150 & 190).

Stamper – Optional stamper automatically clears shear jams.

Ram Hold Downs – Adjustable from the outside of the machine. Also reversible.

Upper & Lower Infrared Actuators – Upper infrareds are located on the access door and are adjustable to the height of the feed hopper.



Conveyor Systems

NEXGEN manufactures EZ-TRAX Conveyor Systems featuring heavy-duty N-Pan steelbelts. They are also used in complete MRF systems that can include slider bed conveyors, sorting lines, sorting bins, baler feeds, platforms, and a variety of configurations for bulk-handling applications.

Visit: EZ-Trax.com

Appendix 2
Baler Weights and Time Trials

Pre-Installation Bale Weights (2010)

Pre Installation	Bale Weight (Kg)	Bales Per Trailer	Trailer Load (Kg)
Jun-10			
PET	334	52	17,390
HDPE	363	48	17,460
Mixed	400	44	17,630
Aluminum	502	30	15,080
Steel	948	25	23,700

Pre Installation	Bale Weight (Kg)	Bales Per Trailer	Trailer Load (Kg)
Jul-10			
PET	326	52	16,960
HDPE	367	48	17,656
Mixed	408	44	17,952
Aluminum	498	32	15,960
Steel	937	23	21,570

Pre Installation	Bale Weight (Kg)	Bales Per Trailer	Trailer Load (Kg)
Aug-10			
PET	344	52	17,920
HDPE	368	48	17,710
Mixed	401	44	17,644
Aluminum	514	31	15,440
Steel	994	24	23,870

Pre Installation	Average Bale Weights (Kg)	Average Bales Per Trailer	Average Trailer Load (Kg)	Average Bale Density (Kg/ft3)
Summary				
PET	335	52	17,423	9.71
HDPE	366	48	17,578	7.79
Mixed Plastics	403	44	17,791	8.6
Aluminum	505	31	15,493	6.87
Steel	960	24	23,047	13.52

Post Installation Bale Weights (2011)

Post Installation	Bale Weight (Kg)	Bales Per Trailer	Trailer Load (Kg)
Jun-11			
PET	565	42	23,457
HDPE	660	32	21,120
Mixed	645	32	20,640
Aluminum	448	44	19,730
Steel	874	22	19,230

Post Installation	Bale Weight (Kg)	Bales Per Trailer	Trailer Load (Kg)
Jul-11			
PET	568	43	24,460
HDPE	656	32	21,010
Mixed	646	32	20,690
Aluminum	440	44	19,400
Steel	866	22	19,060

Post Installation	Bale Weight (Kg)	Bales Per Trailer	Trailer Load (Kg)
Aug-11			
PET	558	43	24,350
HDPE	643	32	20,580
Mixed	640	32	20,510
Aluminum	445	44	19,580
Steel	847	22	18,630

Post Installation	Average Bale Weights (Kg)	Average Bales Per Trailer	Average Trailer Load (Kg)	Average Bale Density (Kg/ft3)
Summary				
PET	564	43	24,089	11.54
HDPE	653	32	20,903	13.35
Mixed Plastics	644	32	20,600	14.11
Aluminum	444	44	19,565	10.46
Steel	862	22	18,973	18.61

Time Trials (Pre and Post Installation)

Baled Containers	Pre Installation Oct. 2011	Post Installation Feb. 2012	Bale Time Improvement
	Bale Time (Minutes)	Bale Time (Minutes)	(%)
Aluminium Cans	11.2	4.55	59.38
HDPE	15.23	5.2	65.86
Mixed Plastic	16.2	5.23	67.72
PET	20.23	7.12	64.80
Steel	13.05	4.25	67.43
Average	**15.18**	**5.27**	**65.04**

Baled Containers	Pre Installation Nov. 2011	Post Install Mar. 2012	Bale Time Improvement
	Bale Time (Minutes)	Bale Time (Minutes)	(%)
Aluminium Cans	12.5	4.15	66.80
HDPE	17.59	5.36	69.53
Mixed Plastic	16.37	5.23	68.05
PET	24.12	8.01	66.79
Steel	14.25	4.35	69.47
Average	**16.97**	**5.42**	**68.13**

Baled Containers	Pre Install Dec. 2011	Post Install Mar.12	Bale Time Improvement
	Bale Time (Minutes)	Bale Time (Minutes)	(%)
Aluminium Cans	13.02	4.50	65.44
HDPE	16.56	5.14	68.96
Mixed Plastic	18.45	6.12	66.83
PET	21.12	6.45	69.46
Steel	13.33	4.02	69.84
Average	**16.50**	**5.25**	**68.11**