



Client	Attention: Bob Fowle
Nu Flow Technologies	Client's Order Number:
1010 Thornton Road South	Date: May 14 2002
Oshawa, Ontario	
L1J 7E2	

**BACKGROUND:** Customer provided one (1) sample for flow comparison analysis. The sample arrived at Triodem on 05/14/2002 via customer supplied courier. Sample inspection was performed at that time and no product defects were noted. Sample submitted to compare theoretical flow rate to similar size clay and cast iron sewer pipe, Analysis to be performed per customer P.O. # 9991 received on 5/14/2002 and signed Triodem quotation dated 5/14/2002. The following additional information is provided:

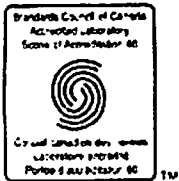
- Sample Description:**
- 1) 4" Clay pipe with Nu Flow Lateral Lining System
  - 2) 4" Clay pipe with joint
  - 3) 4" Cast Iron pipe with joint

**SPECIFICATION:** ASTM F1743-96 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pull In Place of a Resin-Impregnated Tube  
 ASTM C 700-02 Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated  
 ASTM A888-04a Standard Specification for Hub less Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

**PROCEDURES:** Flow (*q*) - per Manning formula and Williams-Hazen formula  
 Coefficients of flow - per PPI Technical Reports

**TEST SUMMARY** According to Triodem's calculations, the reduced diameter of the Nu Flow product does not reduce flow. The Nu Flow product flows better than clay pipe with a joint every 5' and cast iron with a joint every 10' due to the smoothness of the interior and the lack of turbulence.

**RESULTS:** Test results are shown in Table 2, attached.



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### TABLE I DATA

Pipe size was obtained from referenced ASTM specifications for the vitrified clay and c.i.-4-iron products. Nu Flow Liner I.D. was determined by measurements of the product in 4" clay pipe.

<i>Pipe size (D)</i>	4" nominal
Nu Flow	0.310' (3.72")
Clay Pipe	0.333' (4.00")
Cast-Iron	0.328' (3.94")

Manning coefficients were obtained from Plastic Pipe Institute (PPI) Technical Reports. Cast-Iron coefficients were obtained from the City of Toronto Department of Public Works.

<i>Manning coefficients (n)</i>	
Nu Flow	0.010
Clay Pipe	0.015 (good condition)
Cast-Iron	0.013 (new, unlined)

Hazen Williams coefficients were obtained from LMNO Engineering, Research and Software. Ltd. and PPI Technical Reports.

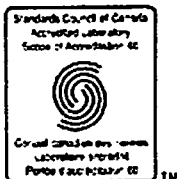
<i>H-W Pipe coefficients (C)</i>	
Nu Flow	150
Clay Pipe	110 - 140 (good condition)
Cast-Iron	130 (new, unlined)
	107- 113 (10yr. old)
	89- 100 (20 yr. old)
	75 - 90 (30 yr. old)
	64 - 83 (40 yr. old)

The friction loss value for insert couplings was obtained from PPI Technical Report *Water Characteristics of Thermoplastic Pipe*. These factors occur every so many feet of pipe. The friction loss was divided by this occurrence to obtain values in ft/ft

<i>Friction Loss</i>	
Insert couplings	12D/occurrence
Nu Flow	0.0
Clay Pipe	0.800
Cast-Iron	0.394

The slope for a standard installation is 0.25"/' per UPC Code. The friction loss detracts from the effectiveness of the slope. Without friction loss, slope is the same. With friction, the slope effectively decreases as a factor of 1 / (1 + Friction loss).

<i>Effective Slope (S) (0.25"/')</i>	0.02083 / (1 + Friction loss)
Nu Flow	0.02083
Clay Pipe	0.01157
Cast-Iron	0.01492



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**TABLE 2**  
**FLOW CALCULATIONS**

**Manning Calculations**

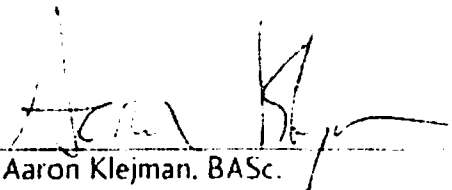
Flow (pipes flowing full), q (gpm) = (207.8/n) x D<sup>2.667</sup> x S<sup>0.5</sup>

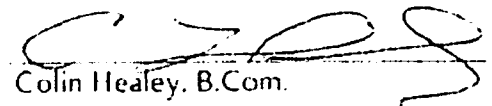
Nu Flow	131.9 gpm
Clay Pipe	79.4 gpm
Cast Iron	99.9 gpm

**Hazen-Williams Calculations**

Flow (pipes flowing full), q (gpm) = 193.9 x C x D<sup>2.63</sup> x S<sup>0.54</sup>

Nu Flow	165.1 gpm
Clay Pipe	106.5 – 135.5 gpm
Cast Iron	68.3 – 138.7

  
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