



WELCOME TO THE
COMMUNITY LIAISON COMMITTEE MEETING 3
FOR THE
CARLISLE WATER SUPPLY
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

July 14, 2014

Presentation Outline

- Overview
- Revised Memorandum of Understanding
- Background Materials
- Data Analysis
- Water Conservation – Timelines and Objectives
- Water Storage Requirements
- Future Demand Projections Scenarios
- Next Steps
- Class EA Schedule

Overview

Based on historical water consumption, growth projections, water conservation measures, design guidelines and planning policies, the focus of this presentation is to provide information on the following questions:

1) Is additional water supply (i.e. a new well) required to service the full development of the Carlisle RSA?

- No.

2) Is additional water storage required to service the full development of the Carlisle RSA?

- Yes. There is currently a water storage shortfall for fighting fires and emergencies in Carlisle.

3) Is an EA still required?

- Yes. The Municipal Class EA process governs the manner for identifying and evaluating solutions for the community.

Key Revisions to the CLC Memorandum of Understanding (MOU)

- Meeting was held with CLC subcommittee on April 29, 2014 to review the MOU
- Summary of Key Revisions:

Section 1.0: Background

- Include more information about the project background and history.
- Include references for Carlisle studies completed since the 2004 Water Supply Master Plan
- Revise the statement explaining the purpose of the study to convey the project will re-evaluate the results of the Master Plan and subsequent studies:

“The purpose of the current Class EA project is to re-evaluate the findings of the Master Plan and subsequent studies and then define a strategy for the provision of municipal water in order to meet the long-term needs of the Community of Carlisle. In recognition of public interest, a Community Liaison Committee (CLC) has been set up to provide an open and cooperative environment for the exchange of ideas throughout the project.”

Section 2.0: Purpose and Mandate

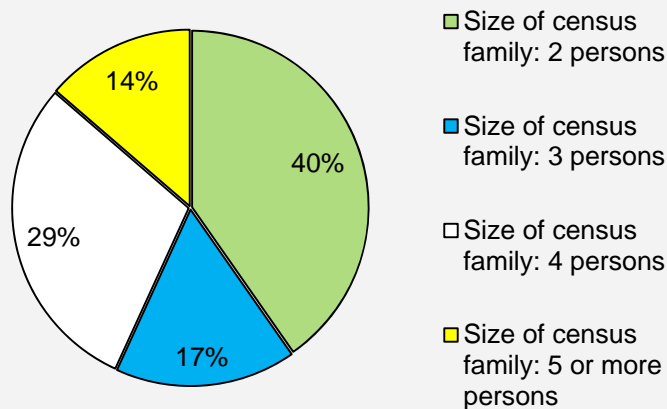
- The revised CLC purpose and mandate:

“The Community Liaison Committee (CLC) has a consultative role and serves as a means to better facilitate community-sourced public input and dialogue. The CLC will provide input on and communicate information about topics related to the EA. The CLC ensures that the interests, local knowledge, historical nuance and views of Carlisle residents are properly acknowledged and represented in the decisions and assessments made through the study process. Furthermore, the CLC provides peer review within the members’ respective professional and personal knowledge for all aspects of the study.”

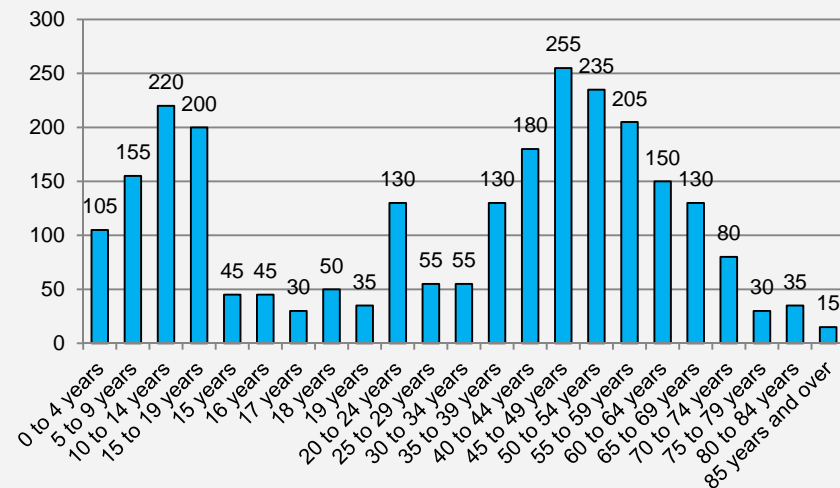
Population Density Based on 2011 Census Data

- The boundaries of the Carlisle RSA do not match the Carlisle Population Centre defined for the 2011 Census. However, the 2011 Census Data can be used to determine a representative Population Density for the Carlisle RSA.
- 2011 Census Data: Population: 2,363 people Private Dwellings: 776
 Population Density (2011): 3.05 people per household
- Assuming the 2011 Census Population Density is representative of the Carlisle RSA, we can apply a population density of **3.05 people per household**.

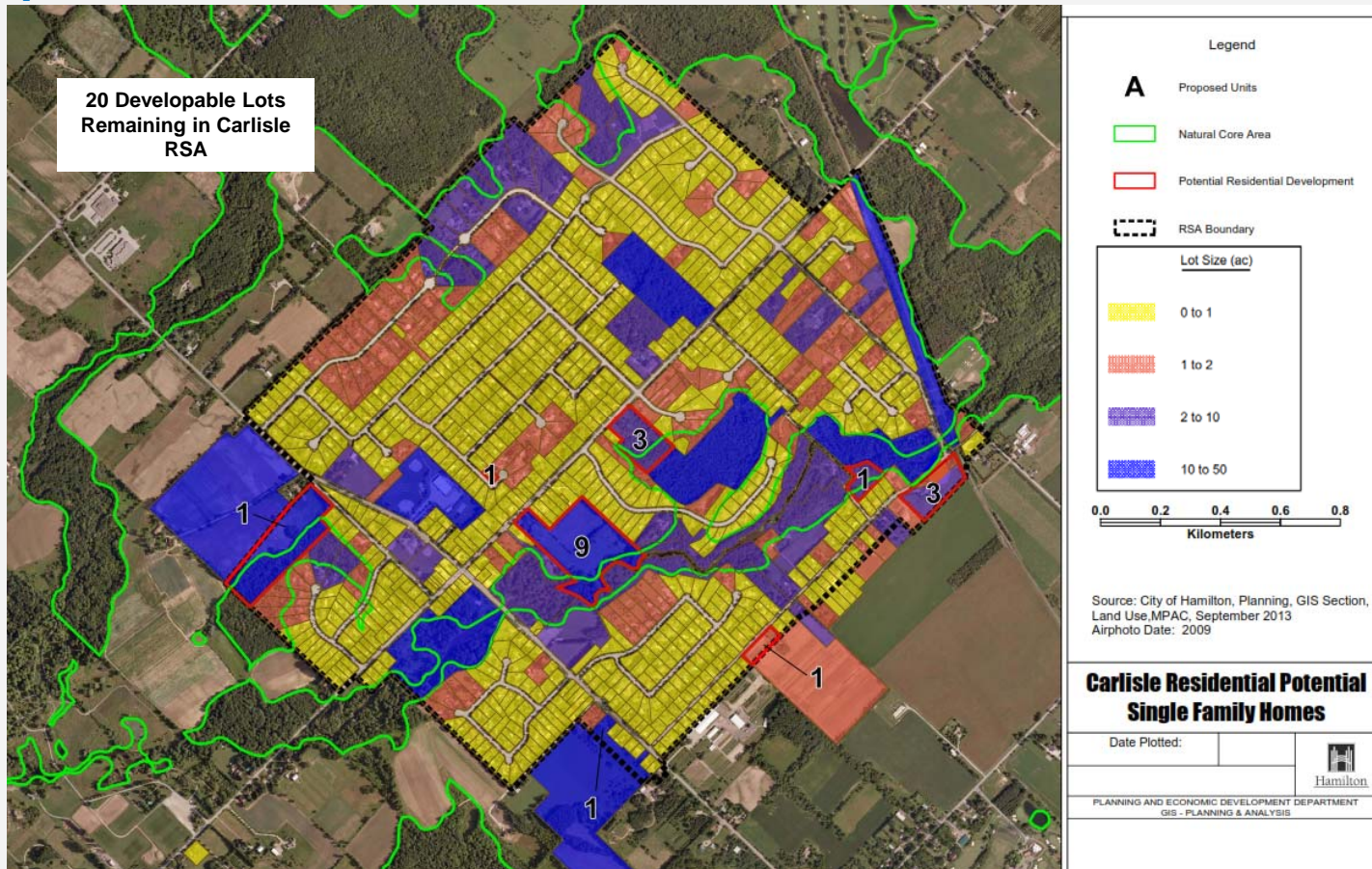
Size of Census Family in Carlisle



Carlisle Age Distribution



Developable Lots in Carlisle RSA

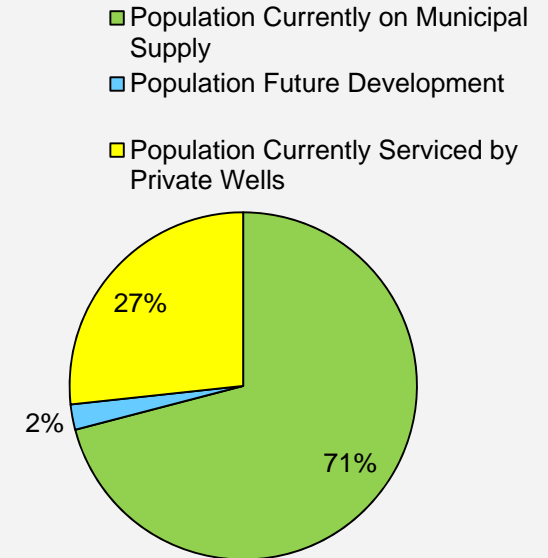


Projected Service Population

- The project will ensure the water supply system can service the full development of the Carlisle Rural Settlement Area (RSA) as defined by the City of Hamilton Official Plan.
- Projection includes the existing population currently serviced by private wells (227) and future development (20).

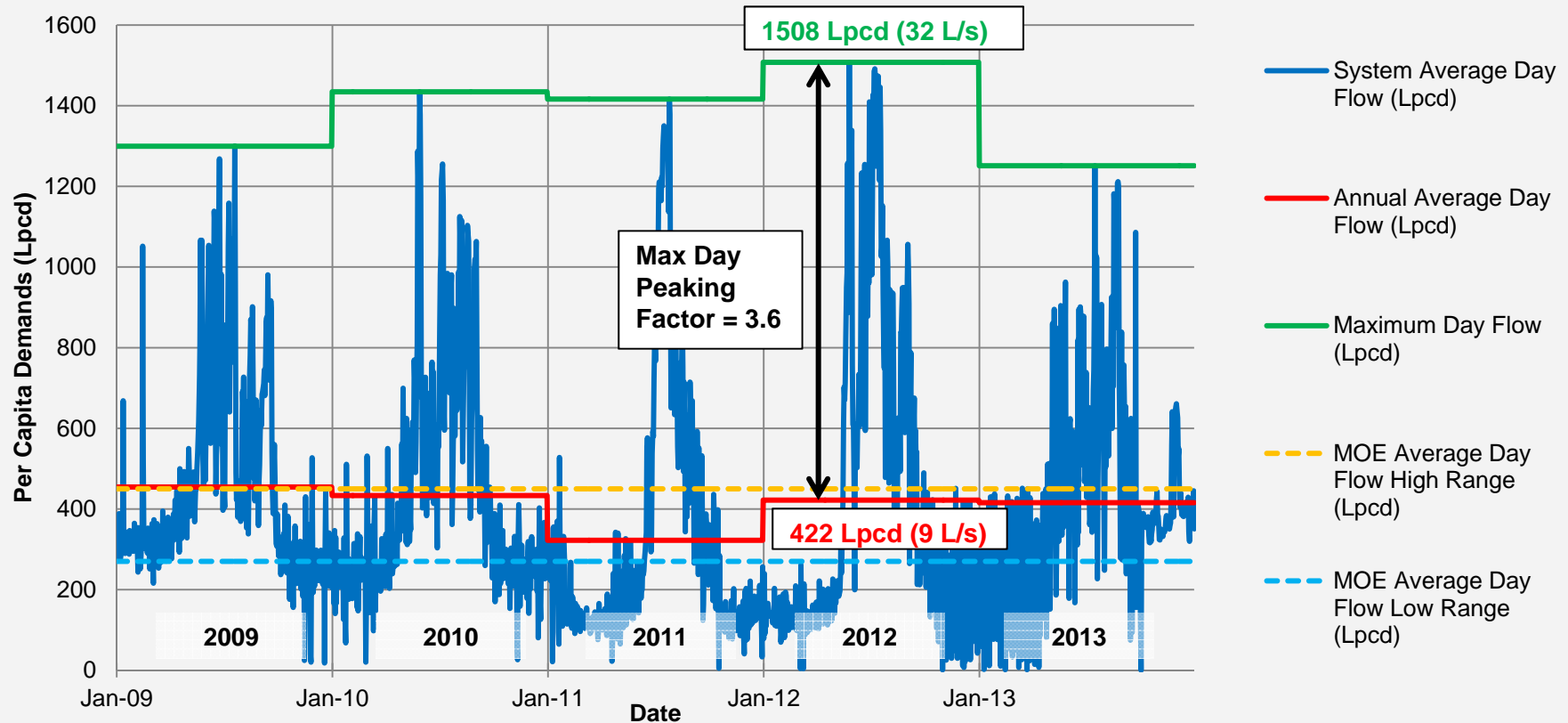
Carlisle RSA	Number of Lots	Population Density*	Population
Currently Developed Lots in Carlisle <i>Confirmed by GIS Count</i>	830		
Currently Served by Municipal Supply (2013) <i>Confirmed from City of Hamilton water meters</i>	603	3.05	1,839
Currently Served by Private Wells <i>830 lots – 603 lots = 227 lots</i>	227	3.05	692
Growth due to Future Development <i>Confirmation provided by City of Hamilton Planning</i>	20	3.05	61
Total Ultimate Projected Population:			2,593

*Population Density assumes 3.05 persons per household in accordance with the 2011 Census Data



Population Service Distribution

Historical Demands 2009-2013 (Lpcd)



Notes:

- Based on a population of 1,839

Summary of Carlisle RSA Historical Demands

Year	Average Day Demand			Maximum Day Demand			Maximum Day Peaking Factor
	m ³ /d	L/s	Lpcd*	m ³ /d	L/s	Lpcd*	
2009	836	9.7	455	2,390	27.7	1,300	2.9
2010	796	9.2	433	2,638	30.5	1,434	3.3
2011	593	6.9	322	2,605	30.2	1,417	4.4
2012	776	9.0	422	2,773	32.1	1,508	3.6
2013	764	8.8	416	2,301	26.6	1,251	3.0

*Lpcd conversion is based on an estimated existing population of 1839.

Year 2012 provides the worst-case scenario for the past 5 years of historical data and will therefore form the basis of the design demand projections.

Water Supply Design Guidelines

- In 2005, City of Hamilton Council adopted the Water and Wastewater Master Plan Policy which established key water policies, including confirming the use of the Ministry of the Environment (MOE) Design Guidelines to determine the minimum acceptable level of water supply and storage. Key policies adopted by Council included:

Table 3-1 Water Policies Summary Table, Policy W.06

“The City of Hamilton shall consider the Ministry of the Environment Guidelines and the Insurance Underwriters Guidelines for establishing the acceptable level of fire flow”

Table 3-1 Water Policies Summary Table, Policy W.07

“The City of Hamilton shall adopt the Ministry of the Environment Guidelines as the minimum acceptable level of water storage”

Table 3-1 Water Policies Summary Table, Policy W.09

“The City of Hamilton shall encourage and promote water conservation”

Table 3-1 Water Policies Summary Table, Policy W.10

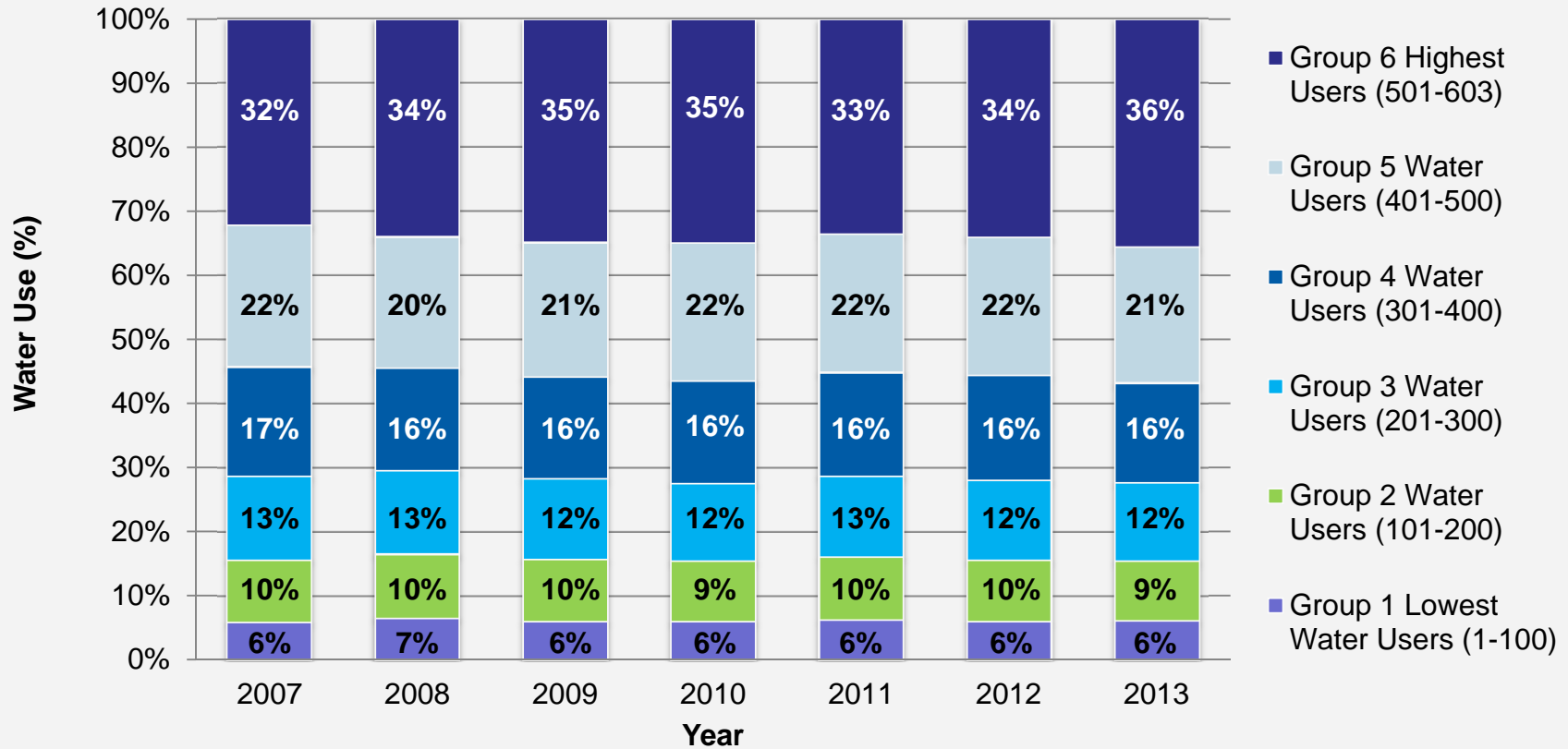
“The City of Hamilton shall utilize reasonable design and costing criteria for establishing and evaluating servicing scenarios. Criteria should be based on historical records and projections thereof; and, MOE Design Guidelines.”

- Therefore the preferred water supply solution will be planned and designed in accordance with the 2008 MOE Design Guidelines for Drinking Water Systems. By extension, the MOE recommends using the latest edition of the Fire Underwriters Survey document *Water Supply for Public Fire Protection* to determine the appropriate fire flow.
- This is standard practice across Ontario.

Annual Water Usage Trend Analysis Summary

- Water billing meter data from 2007 to 2013 was ranked from lowest to highest and divided into 6 groups, each containing 100 billing addresses. A total of 603 billing meters were considered in the analysis.
- While overall water usage varies on an annual basis, the percentage of the total that each group consumes remains fairly constant from 2007 to 2013.
- Over the 7 year timeframe, the top 100 billing addresses (16.6%) consume between 32% to 36% of the total water consumption in Carlisle. The highest ratio occurred in 2013.

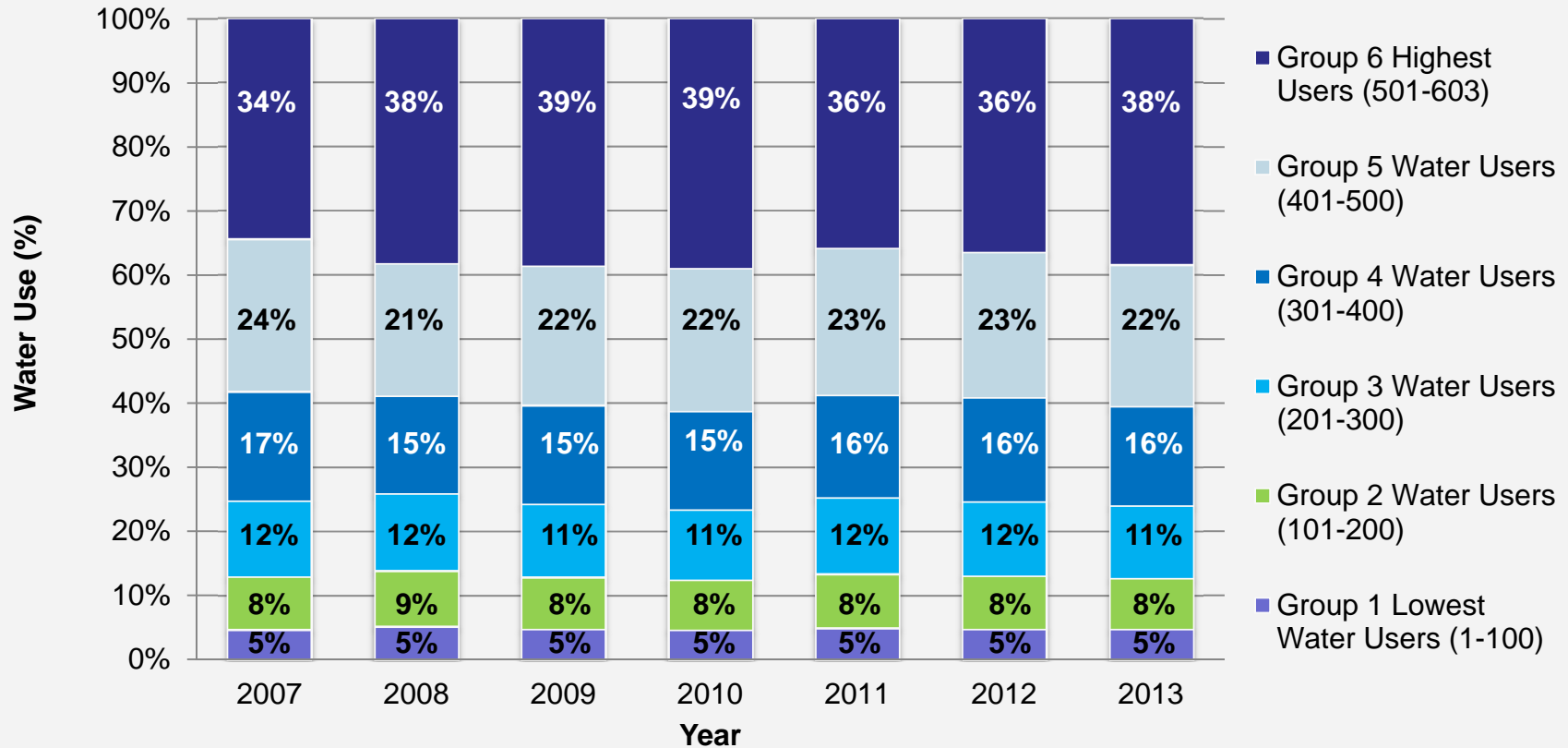
Annual Water Usage Trend Analysis



Summer Water Usage Trend Analysis Summary

- Water billing meter data was ranked from lowest to highest and divided into 6 groups, each containing 100 billing addresses. A total of 603 billing meters were considered in the analysis.
- The following billing periods were reviewed:
 - April/May
 - June/July
 - August/September
- During the summer, the top 100 billing addresses consume between 34% to 39% of the total water consumption in Carlisle based on data from 2007 - 2013. Results for the 6 month summer usage period are provided below.
- The Carlisle and Freelton Peak Demand Report (Neptune 2004) indicated that 76 of 434 homes consumed 44% of the total water consumption in Carlisle, based on 2002 data. Based on the recent data analysis, it appears that the percentage consumption of the top water users has decreased.

Summer Water Usage Trend Analysis (April to September)



Water Conservation - Timelines and Objectives

- The City of Hamilton is planning to undertake a Water Conservation Program for Carlisle through the Customer Service/Community Outreach group.
- The City has obtained preliminary approval to move forward with developing a Water Conservation Strategy:
 - The remainder of 2014 will be used as a “planning year” to develop the new Water Conservation Program.
 - Upon approval, in 2015, the City will execute the plan and begin data collection to monitor the success of the program.
- The City is currently in the process of developing a problem statement for the water conservation program.
- The conservation program will include measurements to determine success.
- **The Carlisle Water Supply Municipal Class EA will be extended until the completion of a 2-year water conservation monitoring period in order to incorporate results from the program.**

Design Criteria for Future Projections

- It is recommended that the **Annual Report** data be used to determine the future Demand Projections.
- The year **2012** will be used as the Design Year since it has the highest Maximum Day Demand (worst case scenario). Design criteria are summarized below:

Design Criteria Based on 2012 Annual Report Data			
	m ³ /d	L/s	Lpcd*
Average Day Demand	776	9.0	422
Maximum Day Demand	2,773	32.1	1,508
Maximum Day Peaking Factor	3.6	3.6	3.6

*Lpcd conversion based on est. population of 1839.

Notes:

- Carlisle Water Supply Study (Stantec 2010) based demand projections on the 2007 average day demand 530 Lpcd, which represented the worst case (highest) per capita demand value over the study period
- The Carlisle Water Supply Study used a maximum day peaking factor of 3.5 for ultimate demand calculations. Maximum day peaking factors for the years 2004 to 2008 ranged from 2.2 to 3.3.

Water Storage Requirements

- Section 8.4.2 of the MOE Design Guidelines for Drinking Water Systems provides the method for sizing treated water storage for distribution systems providing fire protection.
- The following formula is used to calculate the total treated water storage requirement:

$$\text{Total Treated Water Storage Requirement} = A + B + C$$

Where:

A = Fire Storage

B = Equalization Storage = 25% of Maximum Day Demand

C = Emergency Storage = 25% of (A + B)

- There are two methods which can be used to determine the fire flow used to calculate the fire storage requirement:

Method 1) Fire Underwriters Survey (FUS) document *Water Supply for Public Fire Protection*

Method 2) MOE Design Guidelines for Drinking Water Systems Table 8.1

- The City of Hamilton uses FUS as a minimum to determine fire flows.
- The current available water storage in Carlisle is 1.4 ML.

Fire Flow Method 1 – Fire Underwriters Survey (FUS)

- The Fire Underwriters Survey (FUS) is a national organization administered by SCM Risk Management Services Inc. and provides data on public fire protection for fire insurance purposes.
- The City of Hamilton uses FUS as a minimum to determine fire flows.
- **A Public Fire Protection Specialist at the FUS has directly verified the FUS Fire Flow calculations provided herein for Carlisle.**
- The FUS method determines fire flow rates for various building types using the following formula:

$$F = 220 \cdot C \cdot \sqrt{A} \cdot (1 + R_E) \cdot (1 + R_O + R_p)$$

Where:

F = Required fire flow in L/min

C = Coefficient based on material of construction

A = Total floor area in m² (including all storeys, excluding basement)

R_o = Occupancy Factor

R_p = Protection Factor

R_E = Exposure Factor



Fire Flow Requirements - FUS

A) Based on Residential Development (FUS)

- Calculation based on an average residence in the Carlisle RSA with an approximate floor area of **465 m²** (5,000 ft²)
- Assuming wood frame construction ($C=1.5$), occupancy factor for a single family home ($R_o = 0.15$), no sprinkler system ($R_p = 0$) and an exposure of 15 m on two sides of the building ($R_E = 0.24$), the required fire flow would be **7,000 L/min (117 L/s)**.

B) Based on Commercial/ Institutional Development

- Calculation based on the largest commercial/institutional building in the Carlisle RSA (the Carlisle Arena) with an approximate floor area of **3,072 m²** (33,067 ft²).
- Assuming a non-combustible construction ($C=0.8$), occupancy factor for a recreation centre ($R_o = 0.15$), sprinkler system ($R_p = -0.4$) and an exposure of 3.1 to 10 m ($R_E = 0.2$), the required fire flow would be **7,000 L/min (117 L/s)**.

Notes:

- The FUS Fire Flow Calculation is not dependent on population. The calculation is applicable for both existing and future conditions.
- Fire flows have been rounded off in accordance with the FUS procedure.

Summary of Fire Flow Requirements - FUS

Building Name	Total Area (m ²)	Building Construction	Coeff	F	Occupancy Charge (%)	FUS Procedure Step 'E'	Sprinkler Protection Reduction (%)	Exposure 1 (Right) (%)	Exposure 2 (Left) (%)	Total Exposure (%)	Required Fire Flow (L/min)	Required Fire Flow Rounded (L/min)
Carlisle Arena	3,072	Non-combustible	0.8	10,000	-15%	8,500	-40%	10%	10%	20%	6,800	7,000
Residence	465	Wood-frame	1.5	7,000	-15%	5,950	0%	12%	12%	24%	7,378	7,000

- Therefore, based on the FUS Method, the minimum required fire flow to be provided is 7,000 L/min (117 L/s) for 2 hours.

Fire Flow Method 2 - MOE Design Guidelines for Drinking Water Systems

- The MOE fire flow requirements are based on population rather than the actual types of buildings to be serviced (i.e. residential/commercial/industrial) and the fire flow requirements for each.
- A summary of the historical Fire Flow Requirements for small municipalities in Ontario from the MOE Design Guidelines Table 8-1 is provided below.

Equivalent Population	Suggested Fire Flow (L/s)	Duration (Hours)
500 – 1,000	38	2
1,000	64	2
1,500	79	2
2,000	95	2
3,000	110	2

- The **existing service population** of Carlisle is estimated to be **1,839** which corresponds to a fire flow of **95 L/s for 2 hours**.
- The projected **future service population** of Carlisle is estimated to be **2,593** which corresponds to a fire flow of **110 L/s for 2 hours**.

Fire Flow and Storage Comparison and Summary

Guideline	Scenario	Suggested Fire Flow (L/s)	Equivalent Fire Storage for 2 hours (m ³)
MOE Design Guidelines	Existing Population - 1,839	95	684
MOE Design Guidelines	Future Population – 2,593	110	792
Fire Underwriters Survey	Residential Development	117	840
Fire Underwriters Survey	Commercial/ Institutional Development	117	840

- For existing and future fire flow conditions, the **FUS value for fire flow is used** as per City of Hamilton Design Guidelines.
- The fire flow rate of **7,000 L/min (117 L/s) for 2 hours** equates to **840 m³ of water storage**.

Notes:

- The MOE Guidelines state that the method in Table 8.1 may not fulfill the fire protection requirements of the municipality's insurance company or the Fire Underwriters Survey.
- The designer is instructed to refer to the latest edition of the Fire Underwriters Survey document *Water Supply for Public Fire Protection* to determine the appropriate fire flow.

SCENARIO 1 - Average Day Flow and Maximum Day Peaking Factor Based on 2012 Annual Report

Projected Production Requirements

- Based on an updated total population of 2,593 (slide 6), Average Day Demand of 422 Lpcd (slide 7) and Maximum Day Peaking Factor of 3.6 (slide 7)
- Average Day Demand and Maximum Day Peaking Factor based on historical data from 2009 to 2013

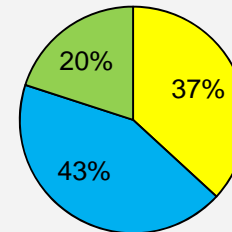
Demand Projections	Flow (ML/d)	Flow (L/s)
Average Day Demand	1.1	12.7
Maximum Day Demand (Peaking Factor of 3.6)	3.9	45.6
Existing Wells Maximum Combined Yield (FDC01, FDC02, FDC03R, FDC05)	4.3	49.8
New Production Capacity Required	-0.4	-4.2

- Therefore, a new well is not required based on the projected Max. Day Demand.

Projected Storage Requirements

- Based on MOE Design Guidelines and Fire Underwriters Survey

Storage Requirements	(ML)
A - Fire Storage (7,000 L/min. for 2 hrs)	0.84
B - Equalization Storage (25% of Max. Day)	0.98
C - Emergency Storage (25% of (A + B))	0.46
Total Required Storage (A + B + C)	2.28
Existing Water Tower Capacity	1.40
Minimum New Storage Capacity Required	0.88



- A - Fire Storage
- B - Equalization Storage
- C - Emergency Storage

SCENARIO 2 – Same condition as as Scenario 1 but assume all well conversions and new development will have reduced average day demands (300 Lpcd) as recommended in the *Carlisle Water Supply Master Plan (2004)*

Projected Production Requirements

- Based on an updated total population of 2,593 (slide 6), Average Day Demand of 422 Lpcd for existing development (slide 7), Average Day Demand of 300 Lpcd for well conversions and new development and Maximum Day Peaking Factor of 3.6 (slide 7)

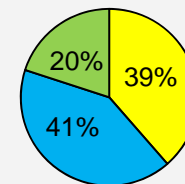
Demand Projections	Flow (ML/d)	Flow (L/s)
Average Day Demand	1.0	11.6
Maximum Day Demand (Peaking Factor of 3.6)	3.6	41.8
Existing Wells Maximum Combined Yield (FDC01, FDC02, FDC03R, FDC05)	4.3	49.8
New Production Capacity Required	-0.7	-8.0

- Therefore, a new well is not required based on the projected Max. Day Demand.

Projected Storage Requirements

- Based on MOE Design Guidelines and Fire Underwriters Survey

Storage Requirements	(ML)
A - Fire Storage (7,000 L/min. for 2 hrs)	0.84
B – Equalization Storage (25% of Max. Day)	0.90
C – Emergency Storage (25% of (A + B))	0.44
Total Required Storage (A + B + C)	2.18
Existing Water Tower Capacity	1.40
Minimum New Storage Capacity Required	0.78



- A - Fire Storage
- B - Equalization Storage
- C - Emergency Storage

SCENARIO 3 – Same Conditions as Scenario 2 with an additional 10% reduction in Average Day Demands and Max Day Demands due to Water Conservation

Projected Production Requirements

- Based on an updated total population of 2,593 (slide 6), Average Day Demand of 380 Lpcd for existing development (10% reduction of 422 Lpcd), Average Day Demand of 270 Lpcd for well conversions (10% reduction of 300 Lpcd), and new development and Maximum Day Peaking Factor of 3.6

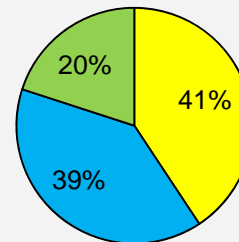
Demand Projections	Flow (ML/d)	Flow (L/s)
Average Day Demand	0.9	10.4
Maximum Day Demand (Peaking Factor of 3.6)	3.2	37.6
Existing Wells Maximum Combined Yield (FDC01, FDC02, FDC03R, FDC05)	4.3	49.8
New Production Capacity Required	-1.1	-12.2

- Therefore, a new well is not required based on the projected Max. Day Demand.

Projected Storage Requirements

- Based on MOE Design Guidelines and Fire Underwriters Survey

Storage Requirements	(ML)
A - Fire Storage (7,000 L/min. for 2 hrs)	0.84
B – Equalization Storage (25% of Max. Day)	0.81
C – Emergency Storage (25% of (A + B))	0.41
Total Required Storage (A + B + C)	2.06
Existing Water Tower Capacity	1.40
Minimum New Storage Capacity Required	0.66



- A - Fire Storage
- B - Equalization Storage
- C - Emergency Storage

Conclusions

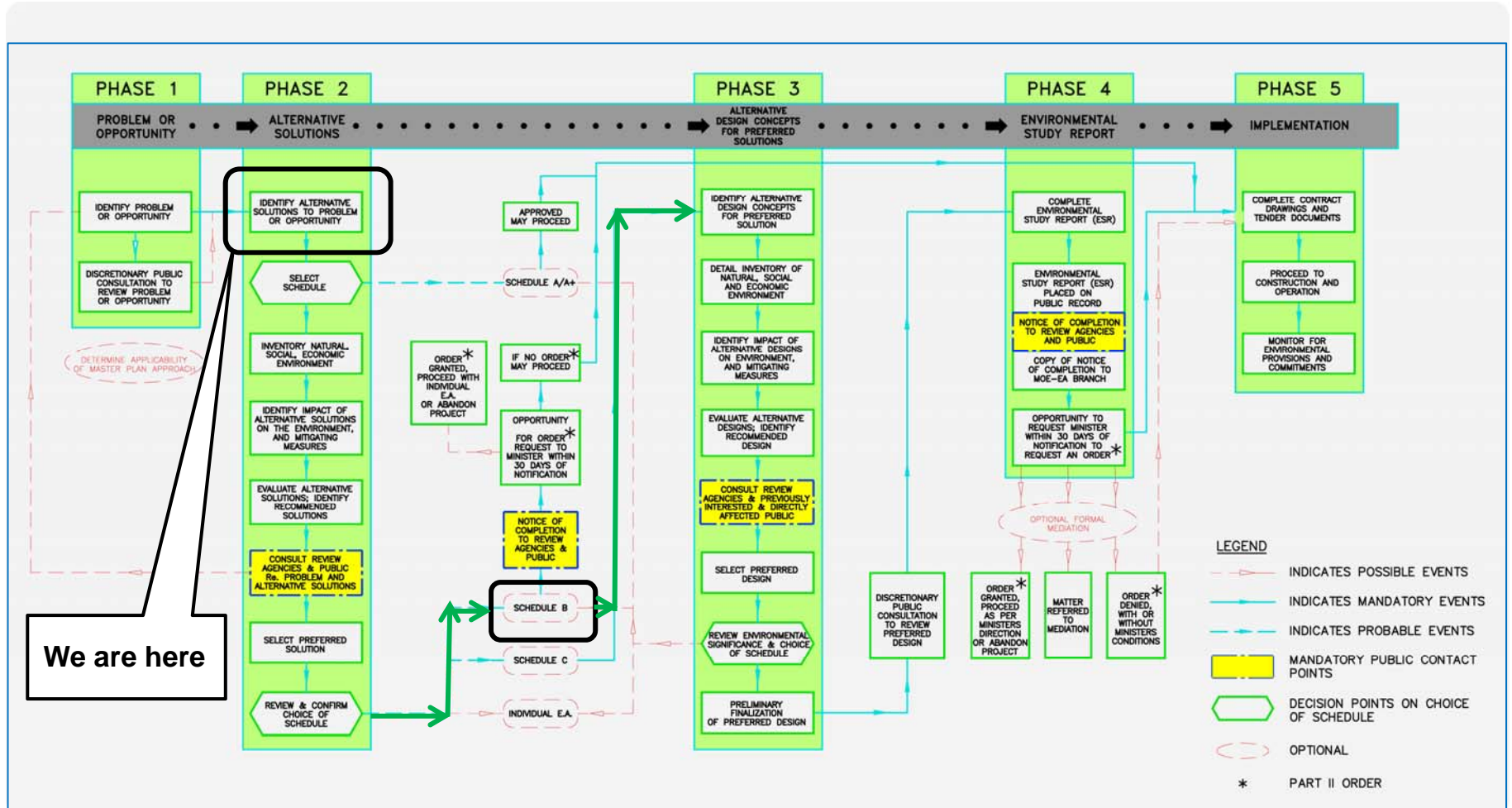
- Based on the historical demand analysis (2009 – 2013), the existing production wells have sufficient capacity to service existing and projected future water demands in the Carlisle RSA, assuming that maximum day water demands do not increase significantly.
- The existing storage capacity provided by the water tower (1.4 ML) is not sufficient to provide the required equalization, fire and emergency storage for the existing and projected population, as required by the City of Hamilton and the MOE Design Guidelines for Drinking Water Systems. Additional water storage is required.

Next Steps

- The project was initiated as a Municipal Engineers Association – Municipal Class Environmental Assessment (MCEA) Schedule 'C' project to *“construct a new water system including a new well and water distribution system”*. As a result of scope changes identified in the project, the MCEA framework defines the project as falling under the Schedule 'B' category *“establish new or expand/replace existing water storage facilities”*.
 - The City will continue with the originally committed public consultation program, including two (2) Public Information Centers (PIC) and CLC meetings in accordance with the Memorandum of Understanding.
- Plan, develop and seek approval to implement a water conservation program. Monitor the success of the program (2 years).
- The Carlisle Water Supply Municipal Class EA will be extended until the completion of the conservation monitoring period in order to incorporate results from the program.
- The next CLC meeting will be scheduled in the fourth quarter of 2014.

Carlisle Water Supply Municipal Class EA

Slide No. 26



Class EA Schedule

