


Improving Water Management in the Great Lakes Basin

Extreme Makeover: How Six Model Municipalities Are Greening Their Water Management Program and Their Bottom Line

May 6, 2014

Project Partners

Great Lakes Commission des Grands Lacs

ECT Environmental Consulting & Technology, Inc.

Alliance for Water Efficiency

Thanks to Our Funder

Great Lakes Protection Fund

www.glpf.org

Project Goals

- Better understanding of environmental and financial implications of water conservation and green infrastructure projects for municipalities by testing in 6 municipalities
- Lessons learnt shared with other municipalities
- Knowledge-transfer techniques set up to keep sharing occurring after project completion

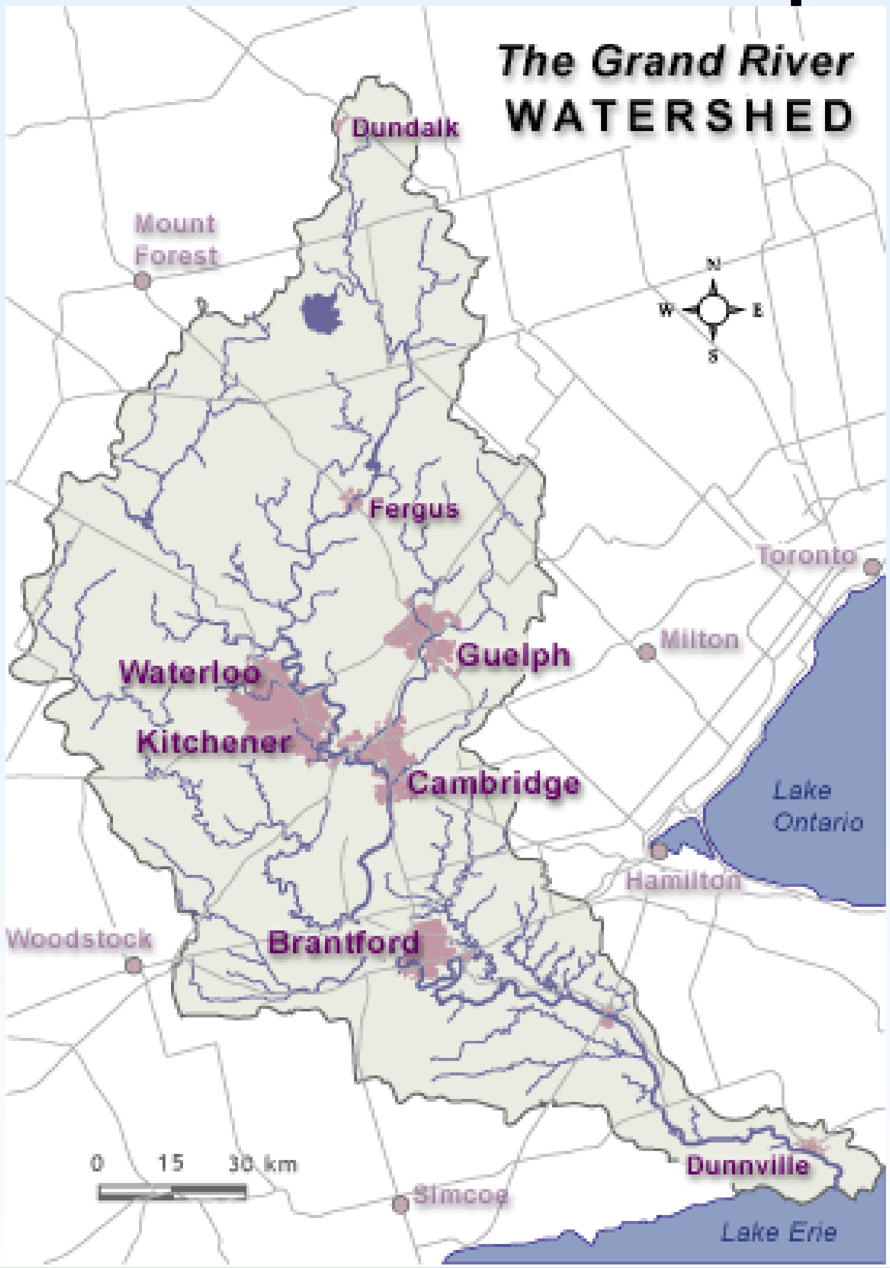
Project Premises

- Integrated view of water system essential in decision-making that combines:
  - Water supply
  - Water conservation & efficiency
  - Storm water
  - Waste water
  - Green infrastructure
- Need to combine short- and long-term perspectives

Project Premises (cont.)

- Need to combine environmental and financial perspectives
- One size does not fit all, but valuable lessons still can be learnt from other municipalities' experiences

The Ontario Municipalities



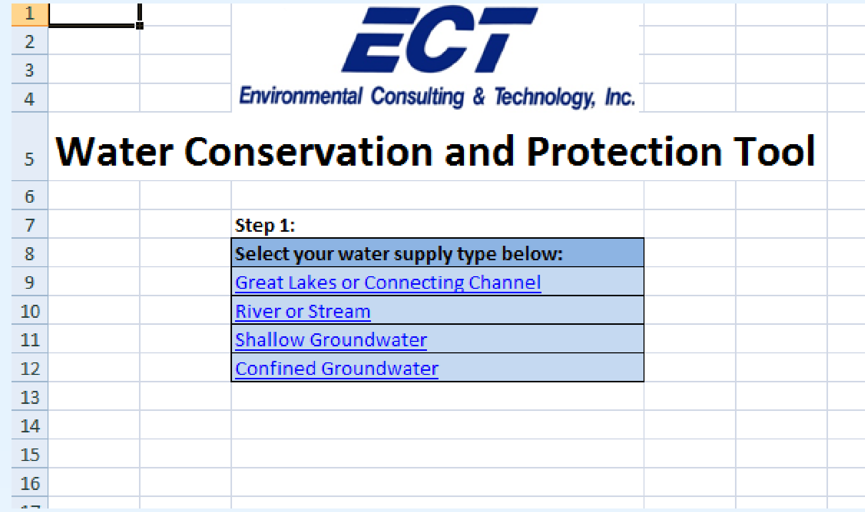
The Michigan Municipalities

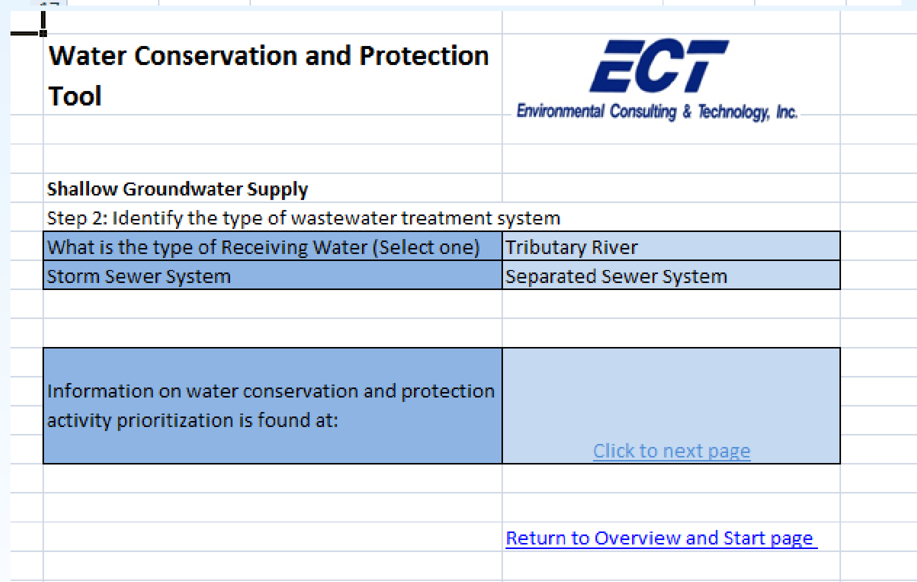
ECT Methodology

- Effects of withdrawals of same amounts of water have different impacts based on:
  - Source type (Great Lakes, shallow groundwater, confined groundwater, river)
  - Type of storm sewer system (combined or separated)
  - Stormwater management practices
  - Location of discharge for treated wastewater (stream, river, ground)
- Timing of environmental impacts differ based on location and factors listed above

Methodology: Environmental Impacts

- Used a tool developed for a project previously funded by the Great Lakes Protection Fund. Looks at the generalized impacts you could expect to see based on research of communities in the Great Lakes.
- Reviewed water use and wastewater impacts in each community.





Water Supply Impacts	
What is your water utility's unaccounted for flow (the amount of leakage from water mains)?	Less than 8%
Do you have a formal leak detection program?	Yes
Do you anticipate growth that will require expansion of your water withdrawal and treatment facilities?	Yes
Are there other communities near yours that draw from the same water supply source?	Yes
What best describes your outdoor water use restrictions?	No water use during daytime
What approximate percentage of your community was built since 1994?	Between 51% and 84%
Is there significant use of curb and gutter and impermeable pavement that directs water into a significant stormwater system?	Yes
What type of development practices are required (or encouraged) in your community?	Conventional Development
Have wetlands in the community largely been eliminated through infill for development?	Yes
Wastewater and CSO Discharges	
Do you anticipate growth that will require expansion of your wastewater treatment facilities?	Yes
Has your wastewater utility treated 25% more water than the water utility pumped for public supply during any of the the last five years?	No
Does the treated wastewater to the receiving water provide additional flow that improves habitat by providing flow, particularly at low flow (for example, increasing levels, allowing for better fish passage)?	Not Sure/Not applicable
Are the bulk of nutrients in the stream caused by nonpoint source runoff?	Not Sure/Not applicable

Clipboard Font Alignment

A1

B	C
Water Conservation, Protection and Management Priorities	
Reduce water use demand	LOW-MED
Reduce Summer water use demand	LOW-MED
Sourcewater protection	MEDIUM
Stormwater management	MEDIUM
Replace hardscape with green infrastructure and permeable pavement	MEDIUM
Low Impact development and Conservation Design	MEDIUM
Leak detection program	CONTINUE PROGRA
Aggressive leak detection and repair	HIGH
Inflow and Infiltration reduction program	HIGH

Pumping from shallow groundwater sources can divert groundwater away from streams that previously contributed to base flow. Potential impacts include: some perennial streams (that flow ye round) becoming more intermittent and intermittent streams more ephemeral (flowing only during parts of a year). As stream flow is reduced from decreased water flowing to the stream, water quali could also decrease. Degradation of water quality, stemming from a reduction in base flow contribution, would be especially pronounced in streams that receive wastewater effluent. Wastewater discharges would provide base flow that may improve stream flow, however, if groundwater is drawn from a watershed that is different from the watershed where wastewater is discharged, one watershed would see a decrease in stream flow, while the other would see a decrease. This would alter hydrology that would also impact plants and the types of plants on the ground, wetlands, as well as fish and other aquatic habitat.

Shallow groundwater water sources are also more susceptible to drought as the water table is sensitive to changes in rainfall and snowmelt. In times of drought, the availability of water is decreased, impacting public water supply and forcing it to compete more with ecological resources that also depend upon the groundwater. The impacts can also be increased in areas where rainfall and snowmelt are diverted through piped storm water systems away from the ground and directly into streams. It decreases the amount of water that would otherwise go to recharge groundwater sources that support public water supplies as well as ecological resources.

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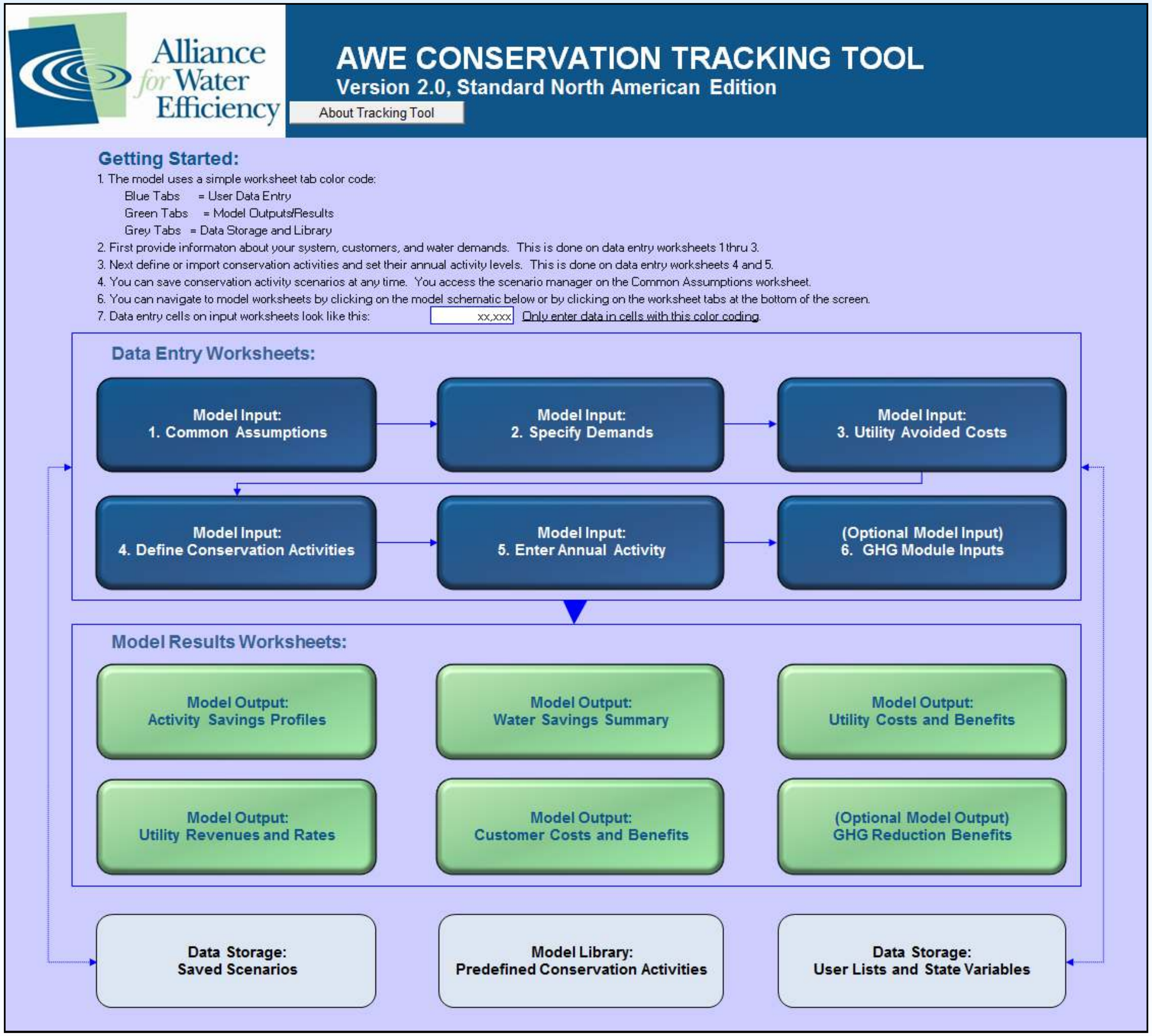
Polluted storm water runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local water bodies. Storm water runoff is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the runoff is discharged untreated. The primary method to control storm water discharges is the use of best management practices (BMPs). In addition, most storm water discharges are considered point sources and require coverage under an NPDES permit. Diversion of storm water from the ground decreases recharge of

AWE Analyzed the Costs and Benefits of Efficiency Programs for Six Communities



Components of AWE Tracking Tool Analysis

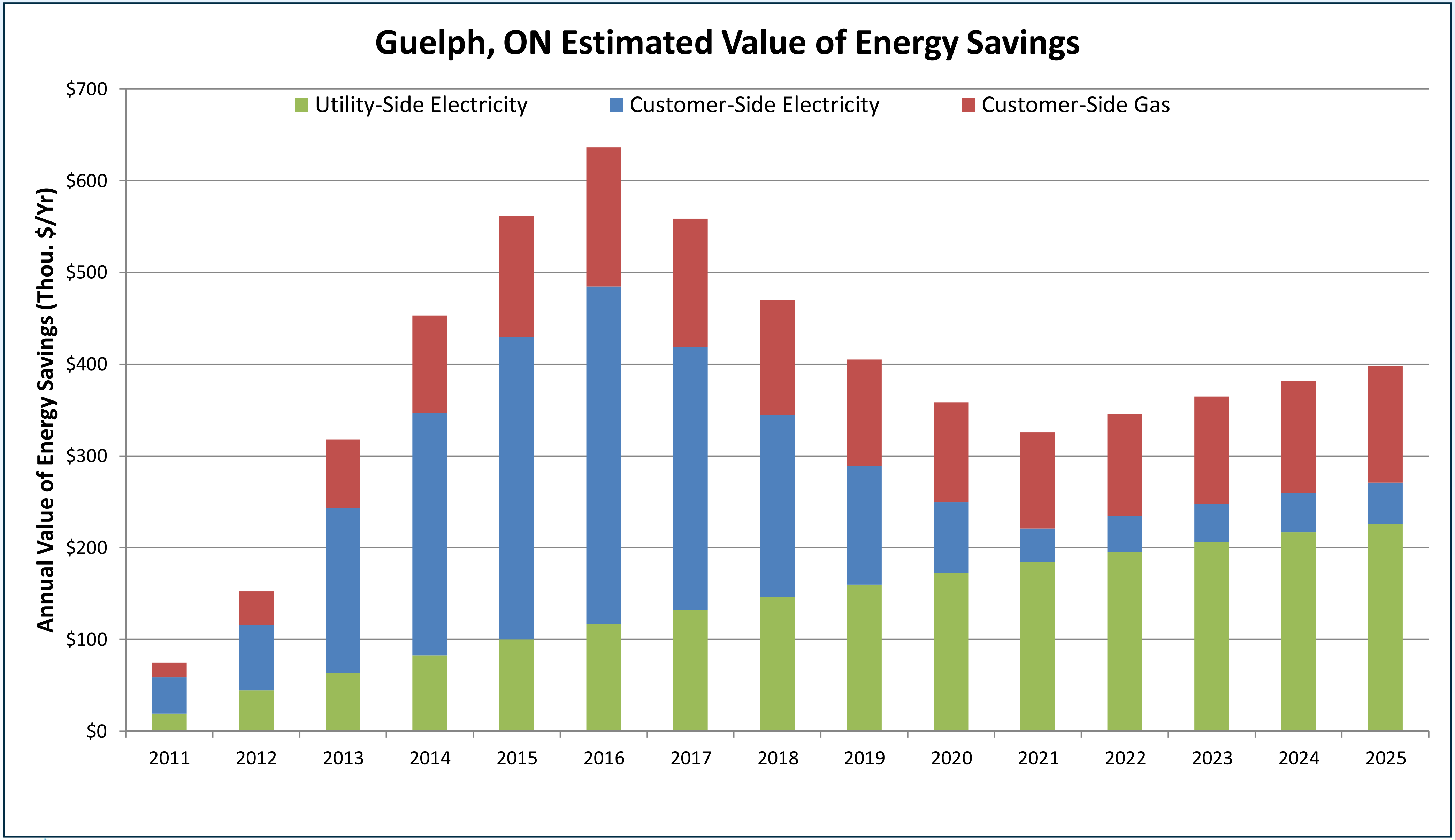
Inputs

- Demographic data
- Weather data
- Customer rates
- Water demand
- Avoided costs
- Efficiency programs
- Greenhouse gas module

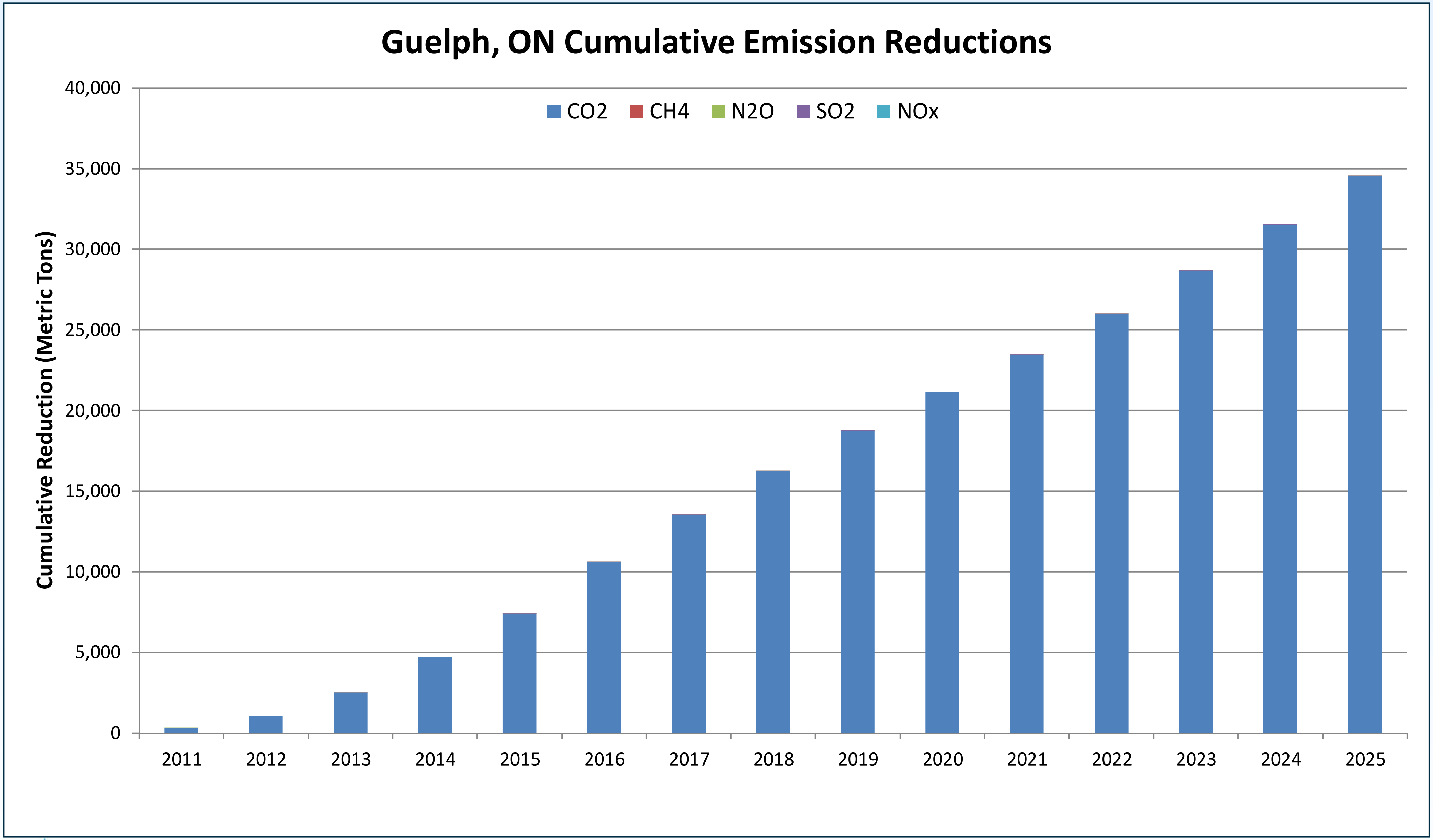
Outputs

- Water savings
- Costs and benefits
- Impact to revenue and rates
- Greenhouse gas and energy reductions

Energy Reduction Benefit Example



Greenhouse Gas Reduction Benefit Example



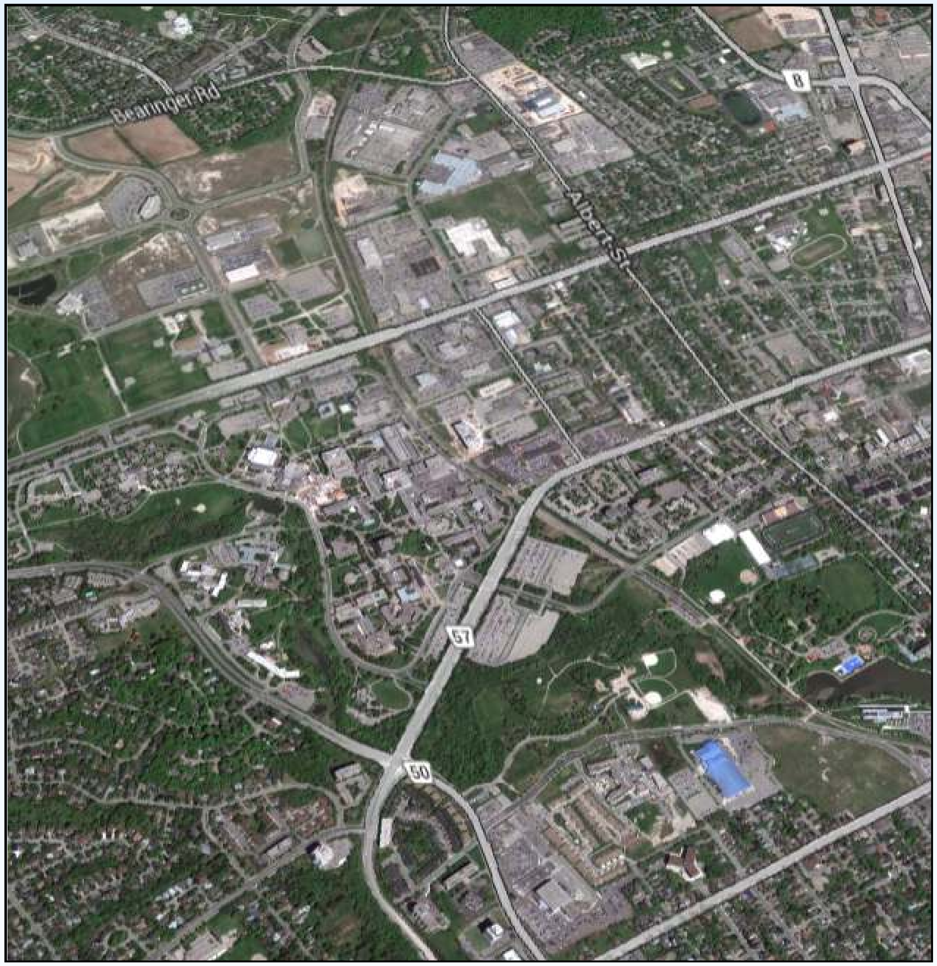
Indoor Water Efficiency Programs Analyzed

- Toilet Replacements
- Toilet Flapper Replacements
- Clothes Washers
- How Water Recirculation Systems
- Voluntary New Home Specifications
- Residential Package Graywater Systems
- Pre-rinse Spray Valves
- Restaurant Certification
- Capacity Buyback Program
- Cooling Towers
- Site Visits
- Education

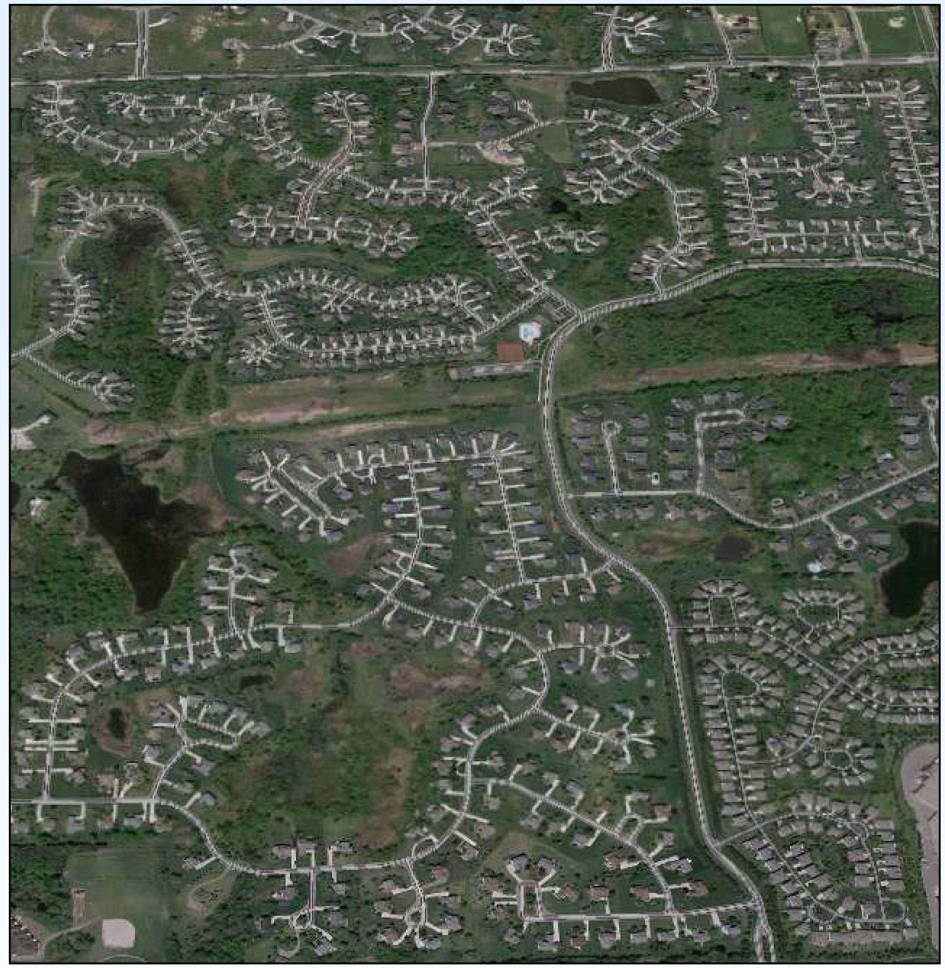
Outdoor Water Efficiency Programs Analyzed

- Landscape Surveys
- Weather Based Irrigation ET Controllers
- Soil Moisture Sensors
- Efficient Sprinkler Nozzles
- Rainwater Harvesting

Service Area Characteristics



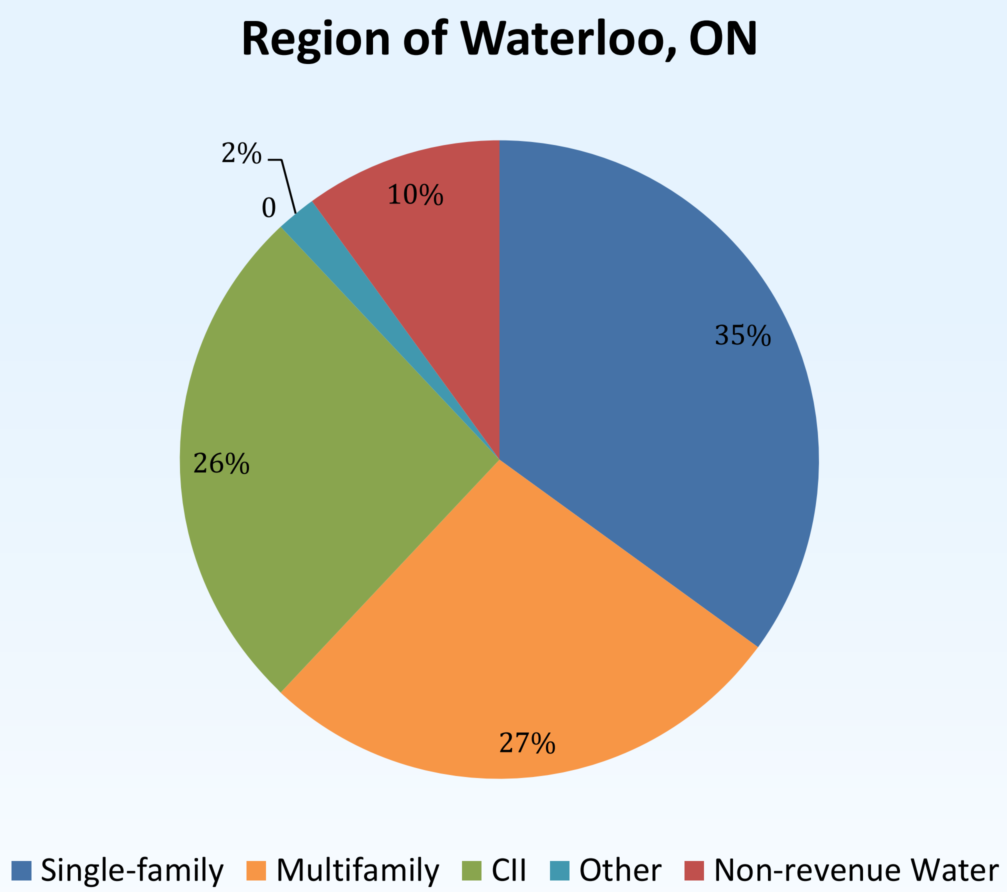
City of Waterloo, ON

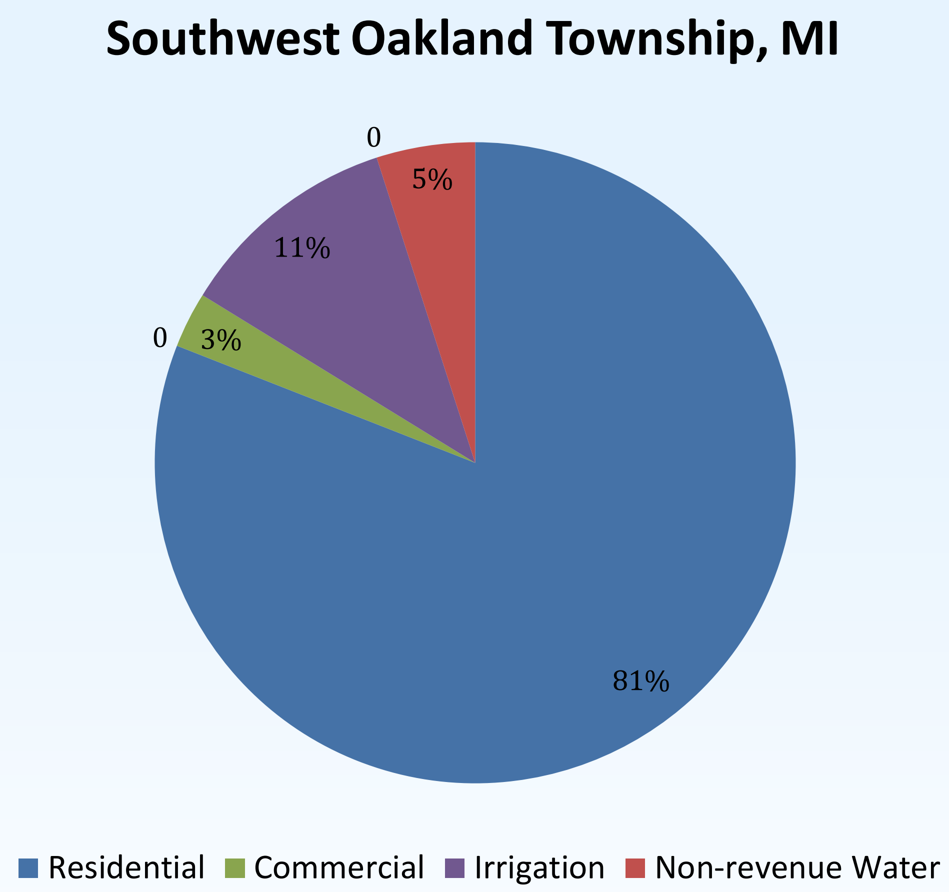


Southwest Oakland Township, MI

Source: Google Earth. 2014.

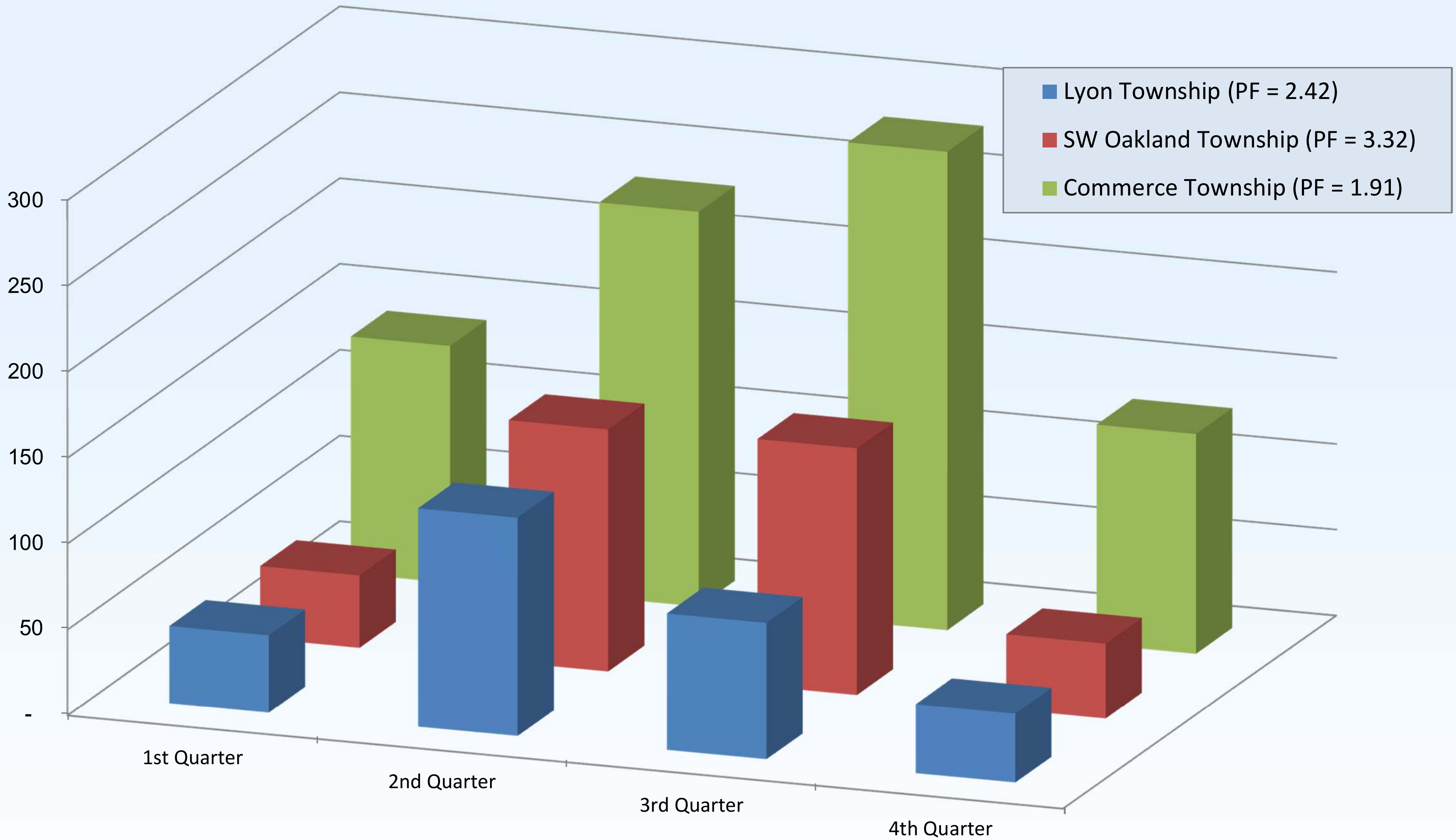
Customer Class Demands





High Peak Water Use Example

Oakland County, MI 2010 Total Water Consumption by Quarter (MG)



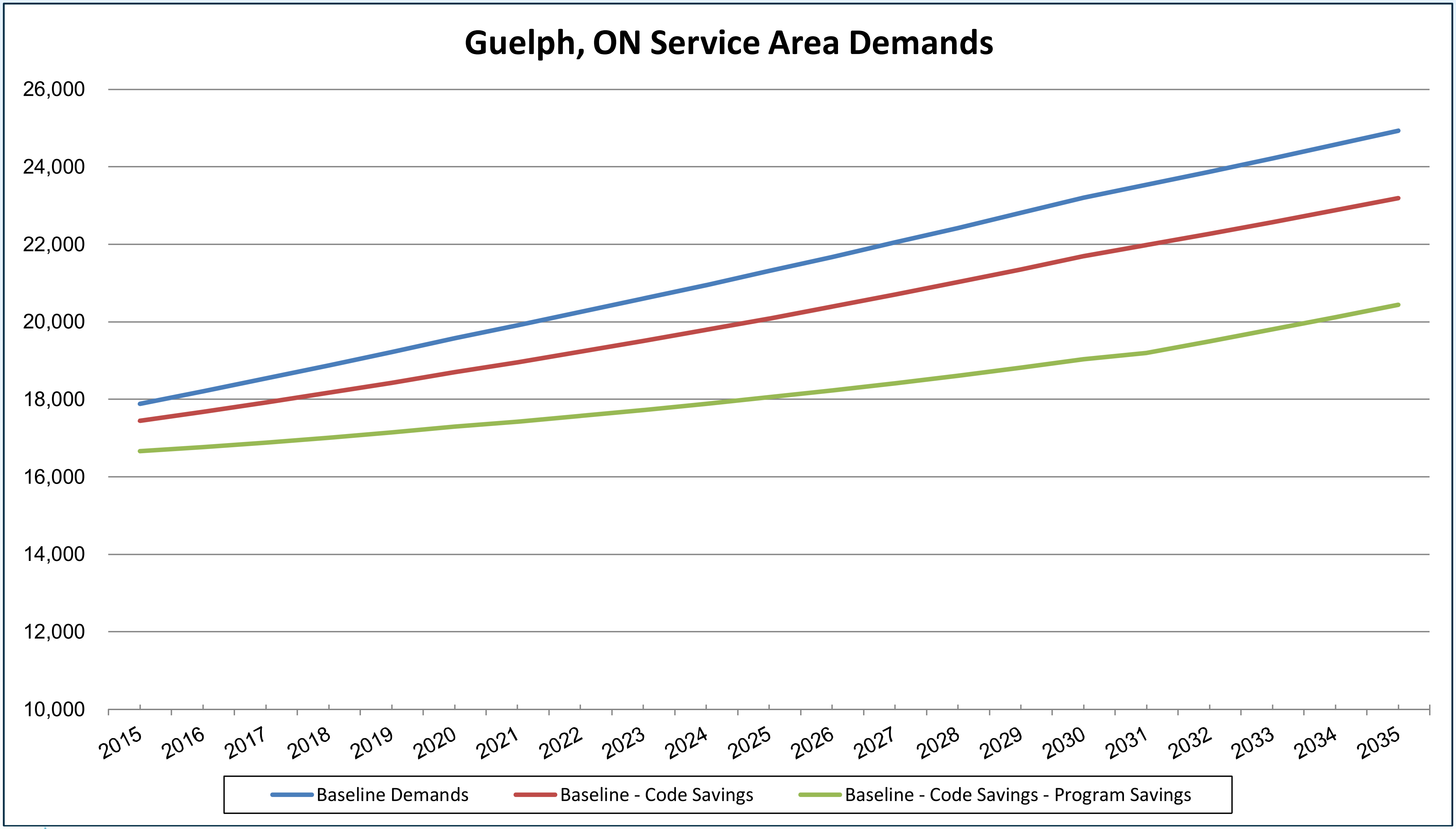
Components of Successful Landscape Water Efficiency Programs

- Target high irrigation users
- Educate contractors and customers
- Follow-up to assess water savings
- Follow-up to ensure equipment is programmed and functioning properly
- For turf that is not replaced with native plants or other options, maintain turf quality

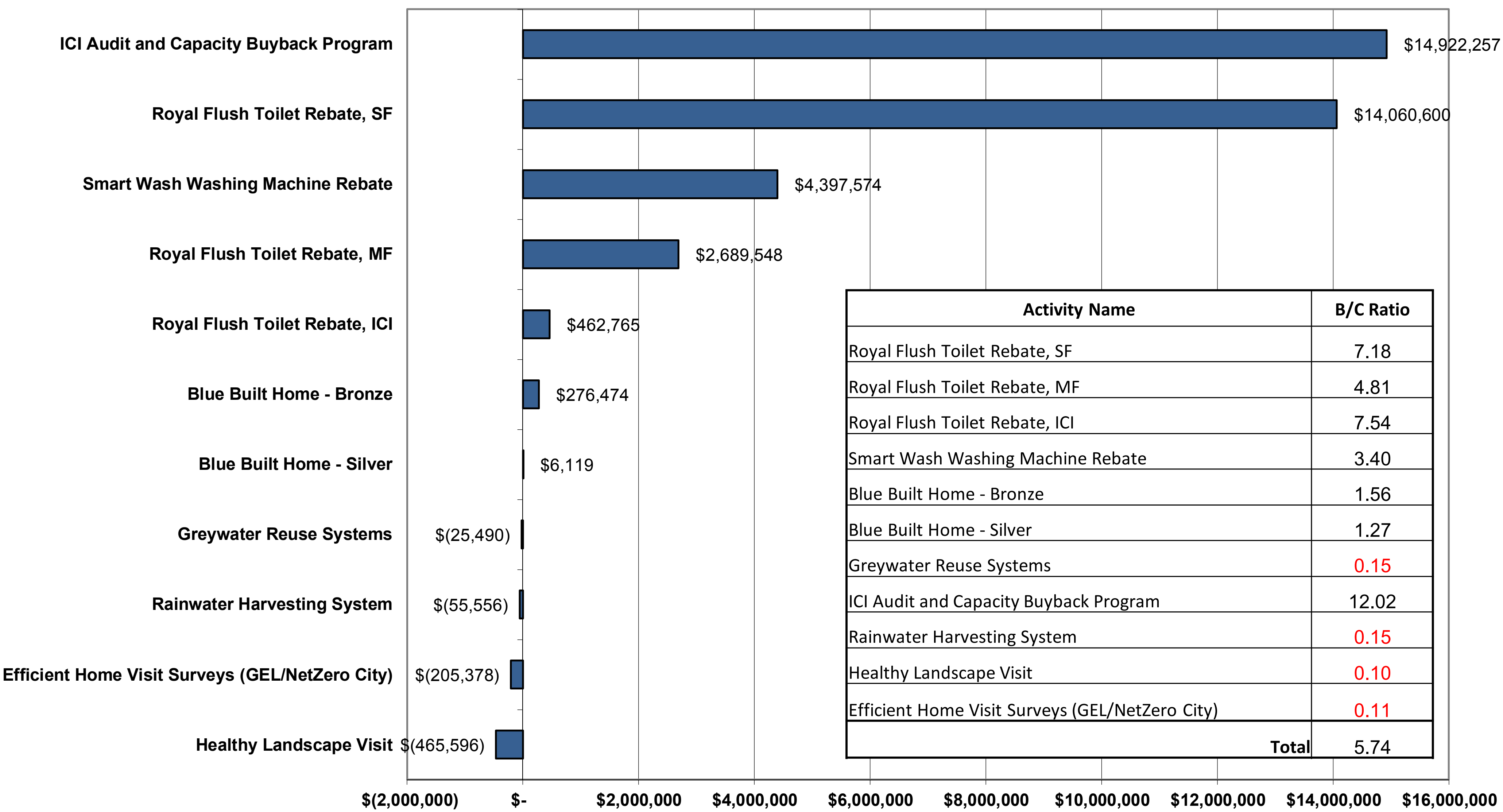
Beyond Incentive Programs

- Rates
  - Inclining Block
  - Seasonal
- Requirements for New Construction
  - Efficient fixtures
  - Irrigation controllers
- Watering Restrictions
- Education and Outreach
- Water Loss Control
- Professional Training and Development
  - WaterSense Irrigation Partner
  - Qualified Water Efficient Landscaper Training (QWEL)
  - Irrigation Association Certification

Demand Scenario Example (ML)

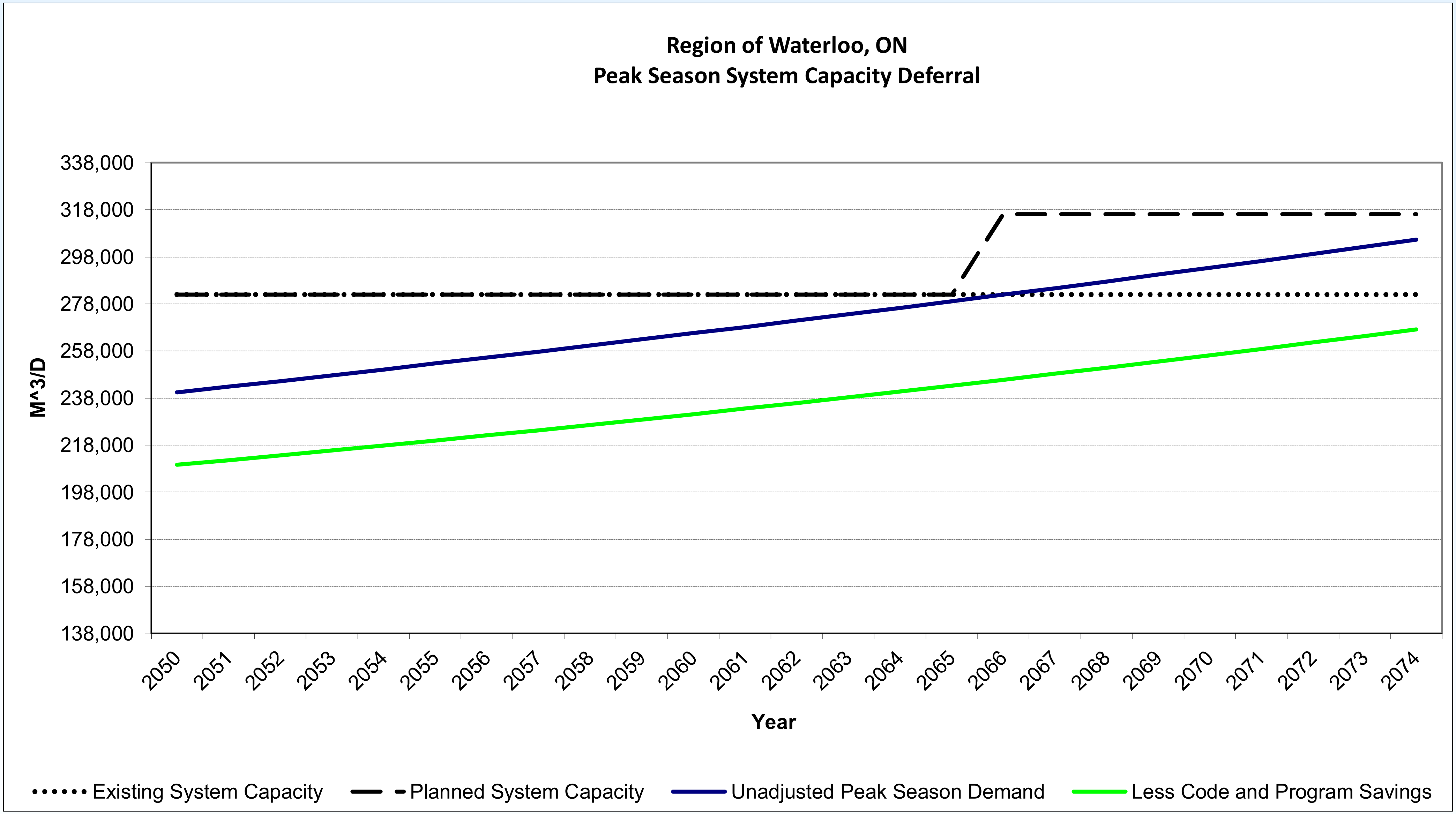


Costs and Benefits Example

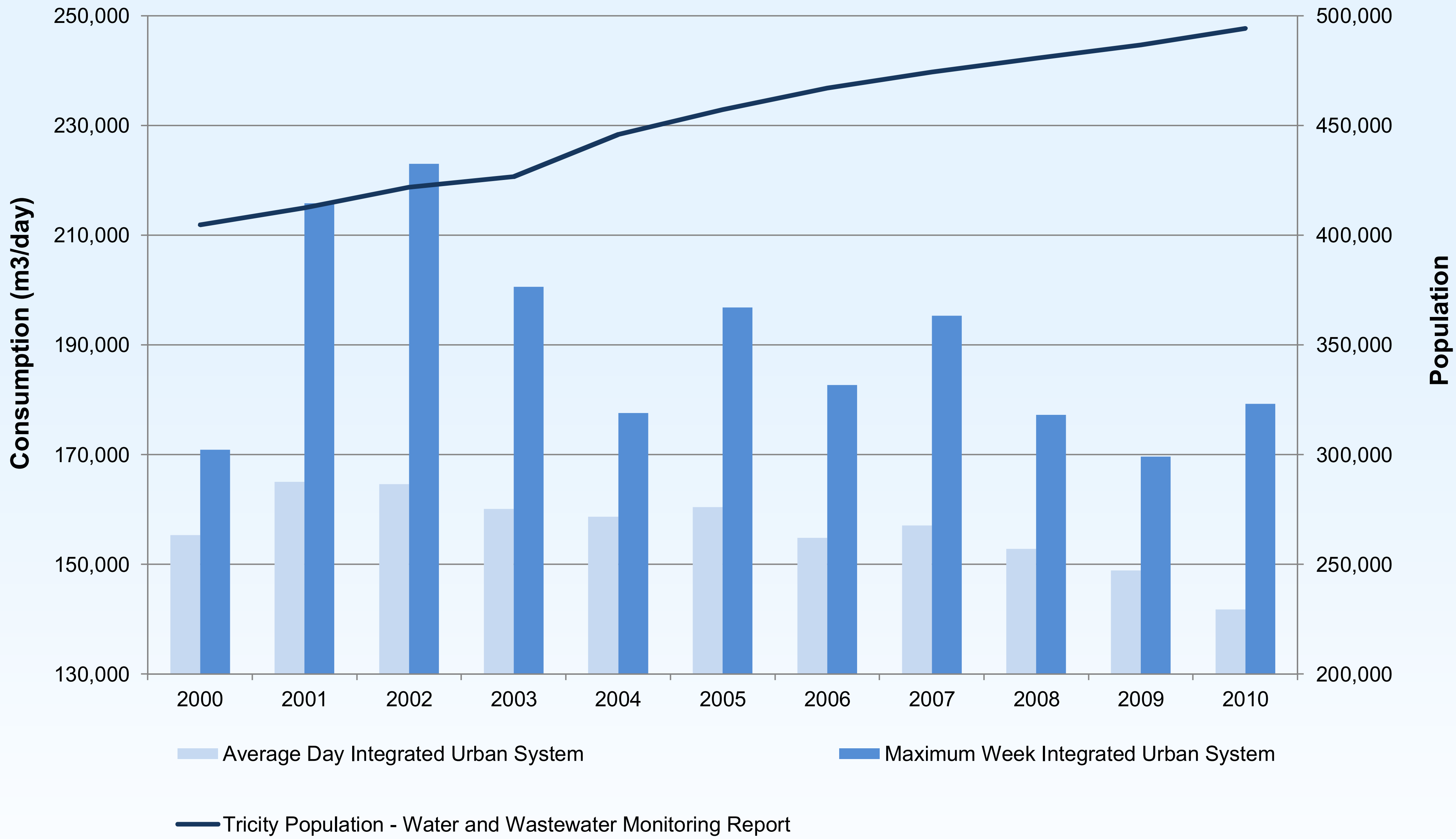


Activity Name	B/C Ratio
Royal Flush Toilet Rebate, SF	7.18
Royal Flush Toilet Rebate, MF	4.81
Royal Flush Toilet Rebate, ICI	7.54
Smart Wash Washing Machine Rebate	3.40
Blue Built Home - Bronze	1.56
Blue Built Home - Silver	1.27
Greywater Reuse Systems	0.15
ICI Audit and Capacity Buyback Program	12.02
Rainwater Harvesting System	0.15
Healthy Landscape Visit	0.10
Efficient Home Visit Surveys (GEL/NetZero City)	0.11
Total	5.74

Deferred Capacity Benefit Example



Region of Waterloo
Average & Maximum Week Water Consumption vs. Population
2000-2010

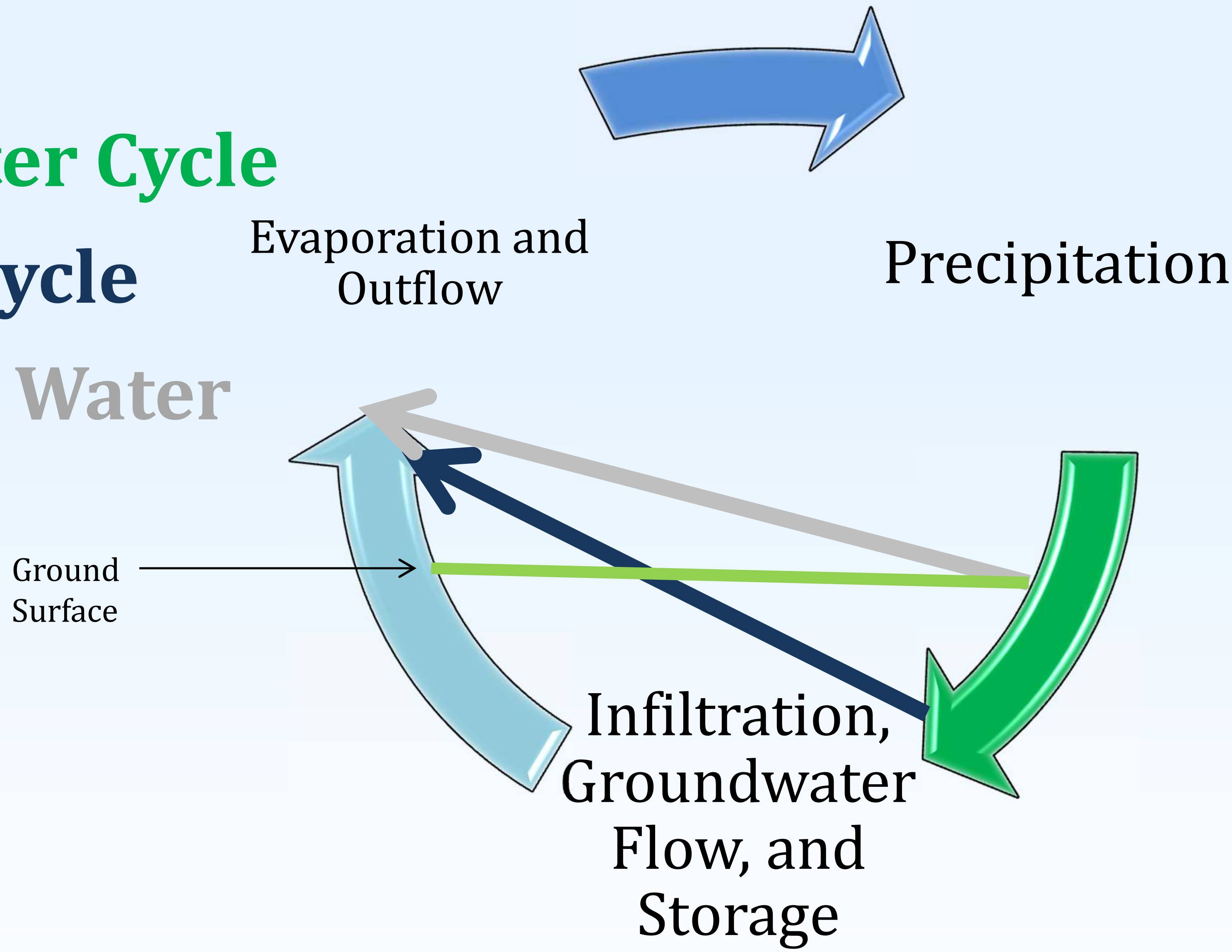


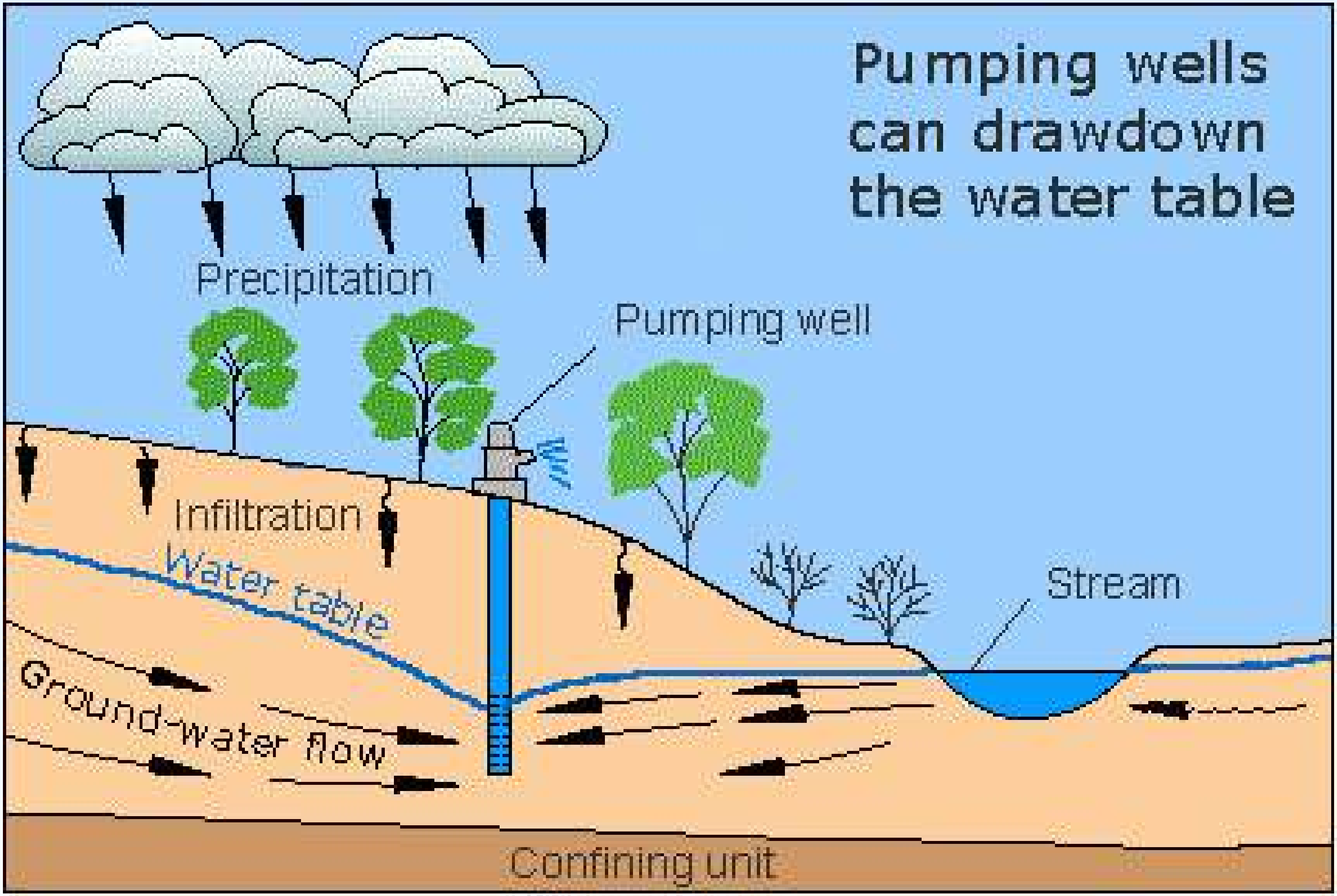
The Three Water Cycles

Natural Water Cycle

Water Use Cycle

Interrupted Water Cycle



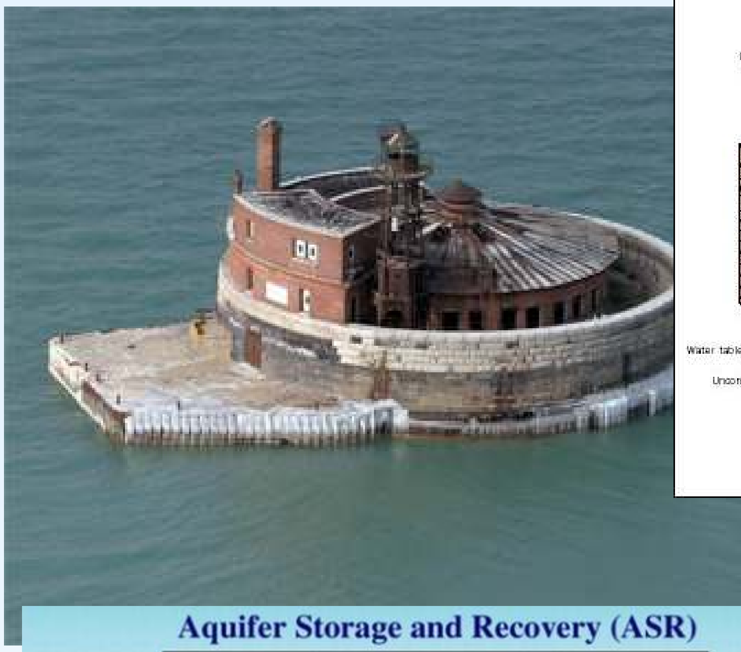

Pumping wells can drawdown the water table
Precipitation
Pumping well
Infiltration
Water table
Stream
Ground-water flow
Confining unit

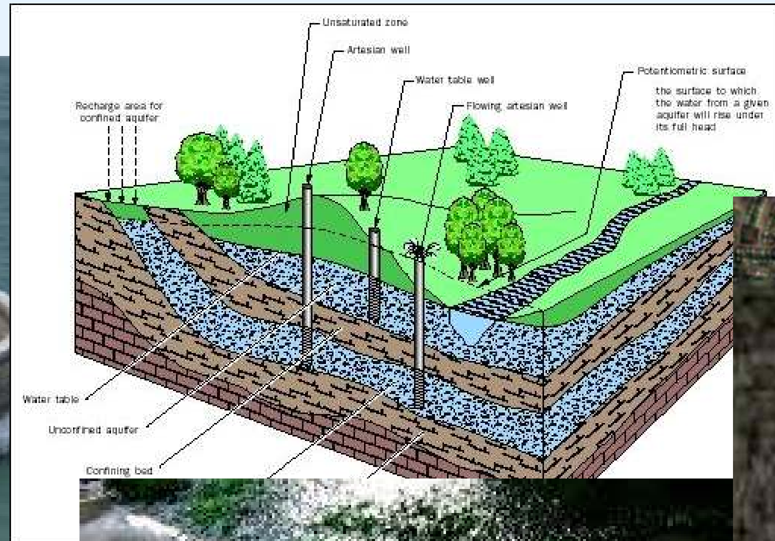
Wells Sensitive to Rainfall and Use

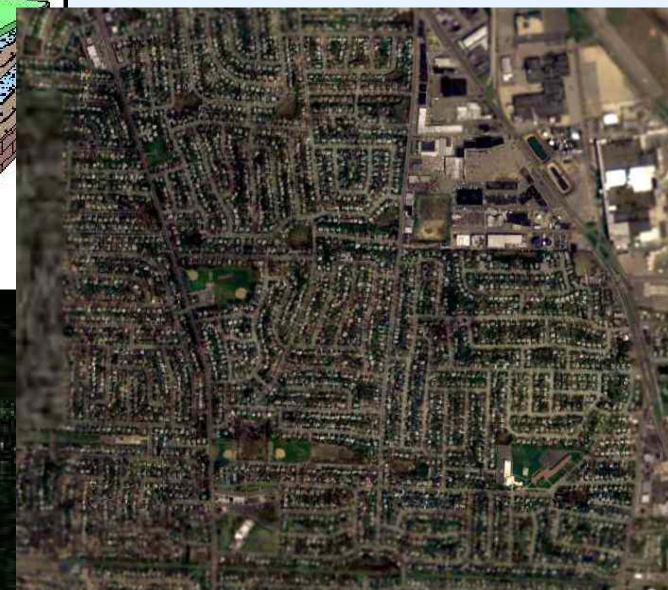
	Static Well Level (Earliest Pump Test)	Static Well Level (2012)
Carriage Club #1 (1998)	58	75
Carriage Club # 2 (1998)	58	73
New Hudson #1 (1998)	18	27
New Hudson #2 (1998)	16	31
Tanglewood #1 (1992)	32	45
Tanglewood #2 (1992)	31	46
Woodwind #1 (2001)	5	30
Woodwind #2 (2002)	7	26

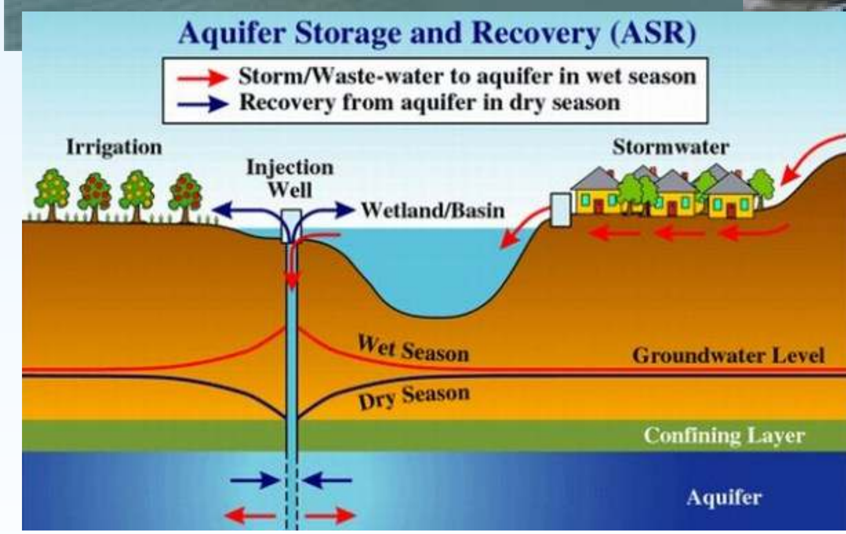
Lyon Township, Oakland County, Michigan wells
Static levels can fluctuate based on rainfall and well use.

Not One Size Fits All









The Cost and Value of Green Infrastructure

	A	B	C	D	E	F	G	H
1						Cost		
2	Management Practice	Proposed Area (ac)	Area (sf)	Volume Captured (cf)	Volume Captured (gal)	Volunteer	Contractor	
3	Urban Reforestation	1.00	43,560	33	246	$ 62,495	$ 110,637	
4	Forest Retention**	1.00	43,560	6,394	48,474	$ 54,784	$ 111,998	
5	Wet Meadow	10.00	435,600	435,600	3,258,724	$ 796,413	$ 796,413	
6	Native Prairie	10.00	435,600	294	2,197	$ 274,616	$ 291,101	
7	Agriculture	10.00	435,600	294	2,197	$ 264,473	$ 280,968	
8	Raingarden	1.00	43,560	24,684	184,661	$ 301,220	$ 772,900	
9	Bioswales**	5,000.00	<----- Enter desired linear feet					
10		2.41	105,000	105,000	785,505	$ 216,058	$ 216,058	
11	**Totals**	**35.41**	**1,542,480**	**572,298**	**4,282,003**	**$ 1,970,059**	**$ 2,580,076**	
12	** Contractor Only							
13	*** Assume 1" storm, D class soil							
14								
15	**Capital costs to build a**	**4,282,003.10**	**gallon conventional retention facility:**					
16	**Cost per gallon**	**$ 3.22**		**Total cost**		**$ 13,795,385**		
17	**Maintenance Costs per gallon over 20 years**	**$ 2.15**		**Total cost**		**9,196,923**		
18				**Total cost**		**22,992,308**		
19	**Treatment Cost Savings Analysis**							
20	Total Projected Treatment and Chemical Savings			**$ 3,583**				
21								
22	**Estimated Power Savings**							
23	Cost of Energy (per KWH)			$ 0.074				
24	Total kWh Saved			**146,864**				
25	Total Projected Power Savings			**$ 10,868**				
26								

Summary of Lessons Learnt for Decision-Making

- Need to take integrated water system approach to planning
- Need to combine both short-term and long-term perspectives
- Central part of solution is a combination of water conservation/efficiency and green infrastructure programs

Keeping in Touch with Us

John Jackson, Project Manager jjackson@web.ca
or 519-744-7503

Project website:

http://glc.org/projects/water-resources/water-mgmt/