APPENDIX

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Sustainable Thurston Phase 1 Outreach Summary

Shared Values and Themes

Shared Values

* Quality of Life * Health and Well Being * Clean Air * Clean Water *

Place - both rural and urban character, and unique identity of each community in the region

Whether talking about Olympia or Bucoda people discussed the small town character, using words like quiet and safe. Rural was used to describe the area surrounding Olympia, Lacey, and Tumwater, as well as much of the south County. Country living, privacy, and space were identified with the rural areas.

Choice – the range of choices provided by our community – neighborhoods, transportation, housing, and lifestyles

People valued the choices our community provides, and recognized that there is not one lifestyle that meets everyone's needs.

Local Decisions – Cross-jurisdictional Coordination and Collaboration

People valued the bottom-up approach to government in our community. Local decision making and accountability, balanced with the efficiency provided by coordination of services and facilities that cross jurisdictional boundaries.

Natural Environment

Puget Sound, beaches, rivers, lakes, forests, wildlife, and open spaces.

Opportunity

People value the opportunities this region offers, from education to jobs to relatively affordable housing to the ability to grow and raise food on their land.

Participation

People value the opportunity to be involved in shaping the future of their community.

General Themes

Category	What People Would Like to See in 2040
Economy	
Business	Business retention, small businesses, more businesses in small cities/towns, local businesses, cottage industries, local entrepreneurs, business opportunities focused around food, focus on tourism, supporting infrastructure (sewer) in Rainier, leadership supporting businesses, regulations that favor small businesses, common sense regulations for businesses, incentives to encourage new businesses, keep our money local, and no more big-box stores
Employment	Jobs, job diversity, greener jobs, jobs in small communities, more jobs downtown less unemployment, regional employment centers, better wages, living wage jobs, manufacturing jobs, pocket industries, university-based hubs, infrastructure for jobs, satellite work centers, live/work opportunities
Education	
Education	Quality education in all school districts in the County, smaller schools, schools located closer to residences, community based schools, magnet schools, open structure (emergence) schools, hope schools, integrate senior centers with schools, workforce training, job opportunities to match education, sustainability education in schools
Environment and Energy	
Energy	Smaller carbon footprint, more local energy, lower energy costs, reduced energy usage, more solar, more renewable energy, self-sustaining in energy, use technology to achieve energy reduction
Environment	Clean groundwater (no pumping wastewater into the aquifer), safe drinking water, clean surface water and streams (less stormwater runoff), protect Puget Sound, clean soil, prepare for climate change (and climate refugees), smaller carbon footprint, improve air quality, maintain wildlife corridors, preserve native species, preserve habitat, decrease noise pollution (from trains)
Open Space	Increase parks, preserves, open space, and rural areas, increase access to open space
Solid Waste	More recycling, re-use of materials, manage solid waste within the County
Food	
Food	Local food production, fresh food, food as an economic/business driver, food for growing population, access to fresh food
Government and Governance	
Government Accountability	Residents able to influence government decisions – decisions made by local elected officials and not appointed boards or councils
Property Rights/Regulations	Property rights balanced with regulations (many comments), taxes
Public Input/Participation	Government that listens to public, more public involvement, more workshops and people communicating
Role of Government	Constitution is still intact – rights are still upheld. Efficient provision of services (more services, less taxes)

Category	What People Would Like to See in 2040
Growth and Land Use	
Growth	Less or no growth, prepare for more growth (climate refugees), have growth pay for impacts of growth, support more growth for businesses
Land Use	Centers – mixed use, infill, clusters, town centers, master planned communities that support transportation options; support and invest in existing communities and centers Transit corridors – concentrate people and activities (live, work, shop, play) Neighborhoods – neighborhood centers, walkability, space and privacy Urban areas – concentrate urban growth in urban areas, reduce sprawl Rural: maintain rural character, support farms and farming Low impact development – reduce the impact of development on the environment
Housing	
Housing	More housing options, options for seniors, youth, military, affordable housing, better mix of jobs and housing, more housing in mixed-use areas, more housing in urban centers such as downtown Olympia, reduce homelessness, more transportation options near housing, housing focused near transit, more character in housing
Natural Resources and Agriculture	
Farming	Preserve and increase farm lands, and support local food production on agricultural lands and through home and community gardens
Natural Resources	Protect and conserve natural resources such as water, energy, forests, agricultural lands
Places	
Beautification	Architectural design, urban design, parks, vibrant downtowns, beautiful neighborhoods, views, balance of nature and buildings, cohesive look or theme to places, trees
Community	Community development, community events, small town feel, things to do, connect communities, community gathering spaces, a more sharing community, a better sense of community where people know each other
Distinct Communities	Choices in communities – rural, small town/cities, urban areas - preserve what is unique, community identity
Gathering Places	Accessible and maintained parks, public spaces, places to meet, shop, play
Heritage/Preservation	Preserve the things that are working now – small town feel, forest lands, rural areas, unique features
Quality of Life	
Access to services	Bus service, health and human services, connecting homes to retail/ services with transportation options such as walking and transit, concentrate services in centers and mixed-use areas, more retail choices
Culture	Arts and cultural events, increased ethnic diversity
Health and Happiness	Increased health and happiness (quality of life)
Human Capital	Forward thinking, smart local people
Multi-generational Needs	Increased opportunities for youth, plan for needs of aging population, create a place for our children and grandchildren

Category	What People Would Like to See in 2040
Safety	
Safety	Increase safety – personal safety and safety of our transportation system
Transportation	
Biking and Walking	Walkable communities, safe trails, bicycle lanes, ability to live, work, go to school, play without a car
Public Transit	Increased transit service, transit service to more areas of the community, enhanced transit such as trolley system, transit links people and services, jobs, transit to parks, compact communities for efficient transit, housing focused near transit
Rail	Commuter rail, light rail, train service to Seattle Rail to support industrial areas, separation of freight rail from community (Bucoda)
Other Transportation	Less congestion, reduce auto-dependence, complete streets, complete by-pass

Source: Phase One Sustainable Thurston Public Outreach.

ADDITIONAL INFORMATION ON INDICATOR DEVELOPMENT

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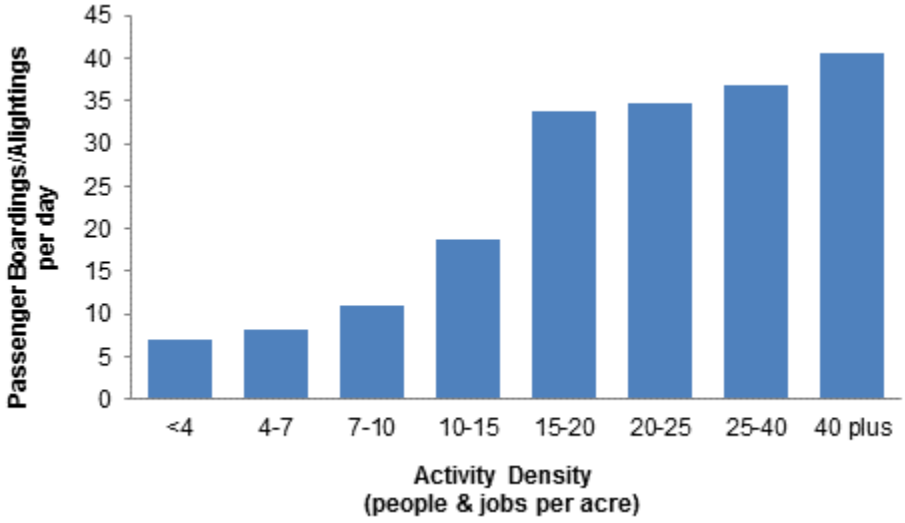
Activity Density and Transit Usage - Additional Information

For the Intercity Transit service area (the northern urban area of Thurston County) a relationship between bus boardings/alightings and activity density was developed by comparing local data sets. As activity density increases, so does ridership on transit. This analysis does not take into account frequency of routes, and other related factors. Transit transfer centers are removed from the data set. This data was not used in the analysis of indicators, but is shown as a local data set to help better understand the significance of indicator results.

Relationship between
Activity Density & Transit Usage



SOURCE: Thurston Regional Planning Council data program; Intercity Transit.

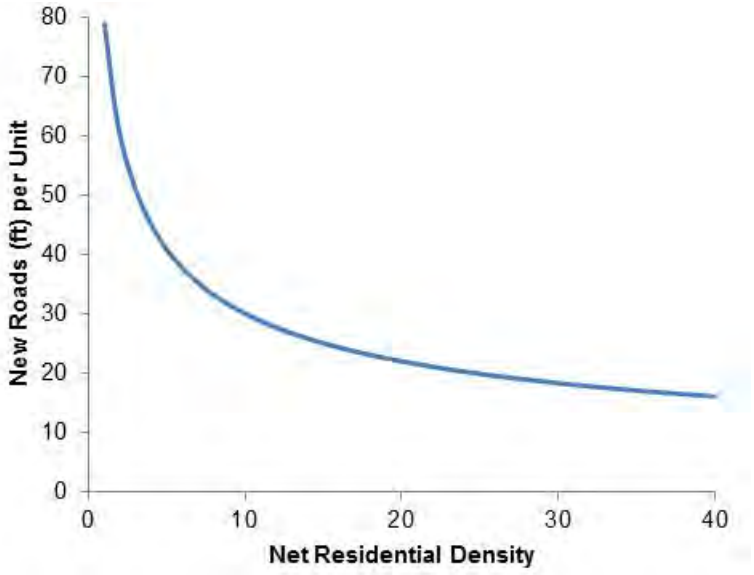
Subdivision Road Construction – Additional Information

TRPC maintains a database of subdivision boundaries of residential long plat subdivisions built in the urban and rural areas since 1970. This database does not capture large lot and short plat subdivisions, which are a fairly large component of rural growth.

Subdivision boundaries are maintained in TRPC's subdivision database and GIS system. Road length was compared to subdivision boundaries. Residential density was derived from the subdivision database.

Please see **Residential Land Consumption** for the relationship between Net Residential Density and Activity Density.

Relationship between
New Roads and Residential Density



SOURCE: Thurston Regional Planning Council data program.

Mix of Population and Employment –Additional Information

The mix, or diversity, of residents with jobs (Diversity) for each grid on the map was measure on a scale of 0 to 1 where:

1 = The ratio of jobs to residents in the grid equals the county-wide ratio.
0 = There are only residents or only jobs in a grid.

$$\text{Diversity} = 1 - \frac{\text{Abs}\left[\frac{\text{County Employment}}{\text{County Population}} - \frac{\text{Grid Employment}}{\text{Grid Population}}\right]}{\frac{\text{County Employment}}{\text{County Population}} + \frac{\text{Grid Employment}}{\text{Grid Population}}}$$

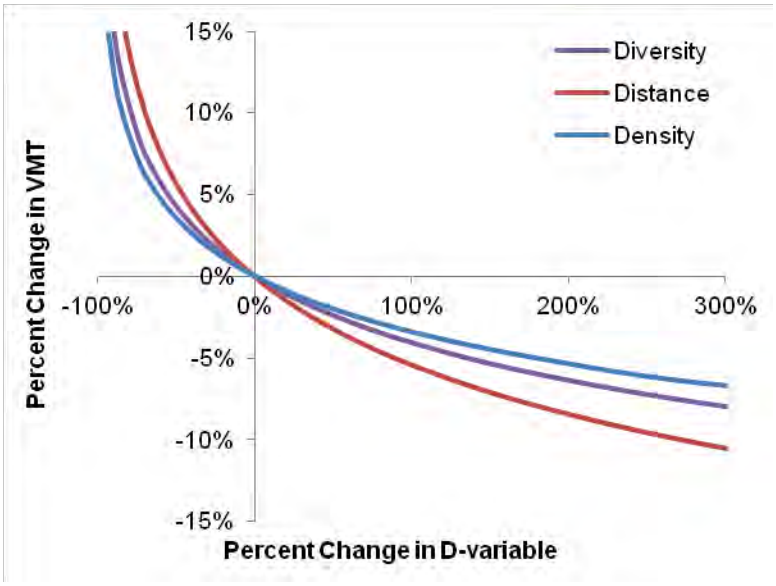
The final number reported is the average diversity for all grids in the county, weighted by population.

Vehicle Miles Traveled – Additional Information

The equations for this indicator are based on a study conducted by Sonoma Technology, Inc., in collaboration with the Washington State Department of Transportation, the Thurston Regional Planning Council, and the Washington State Department of Commerce. These organizations collaborated to develop a web-based modeling tool (Low-Carb Land) to evaluate how changes in land use and future growth affect travel activity and carbon dioxide (CO_2) emissions. More information on the equations and research studies that informed tool development can be found here: http://lowcarbland.sonomatechdata.com/About.aspx.

The equations used to determine the effect of land use patterns on vehicle miles traveled assume that as diversity, distance, and density change, there is a corresponding change in vehicle miles traveled. The amount of change is based on that variable's elasticity. The relationship is show in the graph below:

Relationship between
Change in Land Use Characteristics and
Change in Vehicle Miles Traveled



SOURCE: Low-Carb Land Model Documentation, Sonoma Technology Inc.

Equations

Density

Density was measured as the Activity Density (number of Residents plus Jobs per square mile)

Diversity

Diversity (mix of housing and jobs) was measured as the balance of jobs plus residents. Values range from 0 to 1, where:

1 = The ratio of jobs to residents in the grid equals the county-wide ratio.
0 = There are only residents or only jobs in a grid.

$$\text{Diversity} = 1 - \frac{\text{Abs}\left[\frac{\text{County Employment}}{\text{County Population}} - \frac{\text{Grid Employment}}{\text{Grid Population}}\right]}{\frac{\text{County Employment}}{\text{County Population}} + \frac{\text{Grid Employment}}{\text{Grid Population}}}$$

Note – grid refers to each square mile map grid.

Distance

Distance was measured the number of people within 0.25 mile of a bus stops. This is the average distance people will walk to get to a transit stop.

Vehicle Miles Traveled

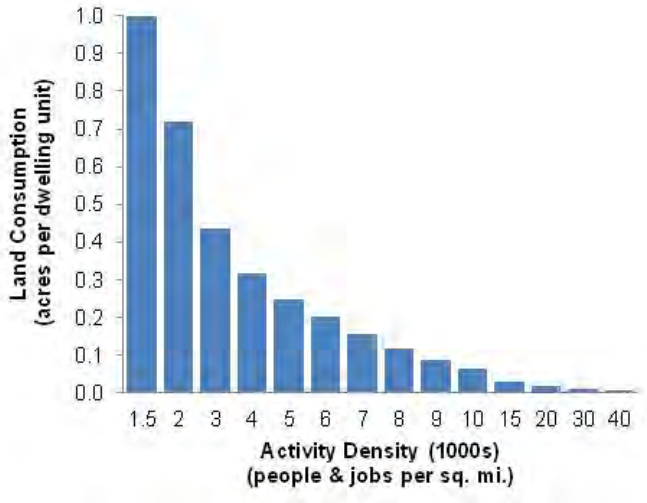
The following equation was used to calculate VMT. The elasticities of VMT with respect to each variable (-0.05, -0.06, -0.08) are from Sonoma Technology's Low-Carb Land Model Documentation.

$$\begin{aligned}\log[\text{VMT 2035}] = \quad & \log[\text{VMT 2009}] \\ & - 0.05 \times (\log[\text{Density 2035}] - \log[\text{Density 2010}]) \\ & - 0.06 \times (\log[\text{Diversity 2035}] - \log[\text{Diversity 2010}]) \\ & - 0.08 \times (\log[\text{Distance 2035}] - \log[\text{Distance 2010}])\end{aligned}$$

Residential Land Consumption – Additional Information

The relationship between activity (people and jobs per square mile) and residential land consumption was generalized from assumptions used in the Buildable Lands Analysis for Thurston County. The relationship was as follows:

Relationship between
Activity Density & Residential Land Consumption



Activity Density (people & jobs per sq. mi.)	Residential Land Consumption (acres/du)	Residential Density (du/acre) rounded	Percent of Growth as Infill and/or Redevelopment
1500 or less	1.00	1	-
2,000	0.72	1.5	-
3,000	0.43	2	-
4,000	0.32	3	-
5,000	0.25	4	4% (infill)
6,000	0.20	5	3% (infill)
7,000	0.16	6	1% (infill)
8,000	0.12	8	-
9,000	0.09	11	3% (redev.)
10,000	0.07	15	40% (redev)
15,000	0.03	34	60% (redev)
20,000	0.02	55	60% (redev)
30,000	0.01	102	60% (redev)
40,000 or more	0.01	136	60% (redev)

TABLE 1: The Relationship between Activity Density and Residential Land Consumption.
SOURCE: Thurston Regional Planning Council data program.

Household Water Consumption – Additional Information

A household's water use was estimated based on its location (urban versus rural), its water source and the type of structure. Households in Washington have three primary sources for water:

- Class A systems, generally metered, serve 15 or more units.
- Class B systems serve 2 to 14 units.
- Private wells generally serve households in rural or low-density areas.

Structure type affects water use as household in multifamily units tend to be smaller and use less water for outdoor uses such as irrigation.

Using data from 18 water systems in Thurston County, a water use rate was estimate for households in each group:

Estimated Residential Water Use Rates
(Gallons per minute)

			With Conservation Measures:			
	Current		Modest		Mighty	
Water System	SF	MF	SF	MF	SF	MF
Class A Cities	210	150	185	130	160	115
Class A Rochester/Grand Mound	260	260	230	230	195	195
Class A Rural	230	230	200	200	175	175
Class B & Exempt Wells:						
Existing Units (2010)	630	630	630	630	630	630
New Units (2010-35)	630	630	630	630	230	230

Assumptions

- For units built between 2010 and 2035, it was assumed that any new unit built within an existing water system would be connected to that system.
- Development occurring within an urban growth boundary but outside an existing water system was assumed to also be connected to a water system.
- Water use for units on unmetered Class B water systems or wells was estimated to be 3 times that of urban households.

Detailed Results:

Baseline land use scenario:

	Total Water Use (million gpd)				Water Use per Household (gpd)			
	Current (2010)	Baseline (2035)	Modest (2035)	Mighty (2035)	Current (2010)	Baseline (2035)	Modest (2035)	Mighty (2035)
Water System Type								
Class A Municipal	12.8	21.0	18.4	16.0	190	190	166	145
Class A Rural	3.9	4.8	4.2	3.7	232	232	202	176
Class B & Exempt	15.2	18.1	18.1	12.9	630	630	630	447
Jurisdiction								
City	10.4	15.4	13.5	11.7	197	187	164	143
Reservation	0.1	0.2	0.2	0.1	527	559	553	374
Rural	16.5	20.5	20.2	14.8	492	507	498	366
UGA	4.9	7.8	6.9	5.9	226	211	185	158
Total	**31.9**	**44.0**	**40.8**	**32.5**	**295**	**274**	**254**	**203**

Developing Estimates:

TRPC collected data on household water usage for selected Class A water systems in Thurston County. Outside of Class A water systems accurate data on water consumption is hard to find. Because usage is unmetered households do not know how much water they use. Households do not pay a per-gallon rate, so there is no financial incentive for conservation. Furthermore, houses tend to have larger lawns requiring more water for irrigation. For these reasons, local planners estimate water usage on Class B systems and Exempt Wells to be two to three times that of a rural subdivision.

Reported per Household Water Use Rates (gallons per day) for Thurston County Jurisdictions.

	Rainier 2012	Olympia 2004-07	Olympia 2011	Lacey 2011	Tumwater 2006-08	Yelm 2006-07	Grand Mound 2005-10
Single-Family	182	198	159	169	*	215	282
Multifamily	n/a	123	109	n/a	*	n/a	n/a

Note: *Tumwater data only reported by connection, not by household.

Reported per Household Water Use Rates for Class A Water Systems serving Rural Subdivisions.

Class A Water System	Gallons per Day per Household	Owner
Black Lake Estates	230	Washington Water Service Co.
Boston Harbor	166	Thurston County
Cornerstone Estates	282	Thurston PUD
Covington	265	Thurston PUD
Creekside Meadows Div. 2	200	Washington Water Service Co.
Crowder Rd	244	Thurston PUD
Foxhall	270	Washington Water Service Co.
Grandview	204	Rochester Water Association
Lake Lawrence	160	Washington Water Service Co.
Lazy Acres W1	229	Thurston PUD
Lew's 81st	205	Thurston PUD
Loma Vista	311	Thurston PUD
Nisqually Highlands	561	Thurston PUD
Pederson Place	340	Thurston PUD
Prairie Ridge	565	Thurston PUD
Prairie Villa	274	Thurston PUD
Prairie Vista	201	Rochester Water Association
Scott Lake	180	Washington Water Service Co.
Smith S Prairie	327	Thurston PUD
Sunwood Lakes	190	Washington Water Service Co.
Tamoshan	204	Thurston County
Tanglewilde	244	Thurston PUD
Tolmie Estates	234	Thurston PUD
Average	**231**	**(Weighted by # Connections)**

Residential Energy Consumption – Additional Information

Total Residential Energy Use is the sum of energy used in both homes and cars.

Housing Type Energy Usage

Housing unit type is important because multifamily units tend to use less energy due to their smaller size and the insulation provided by adjoining units. The average multifamily residence in Thurston County uses 26% less energy than the average single-family residence:

Thurston County
Annual Residential Energy Usage

PSE Customer Type	Structure Type	# Units[1]	Electricity[1] (kWh)	Natural Gas[2] (therms)	Total (M Btu)
Electric Only	Single-Family	33,347	17,058	0	58.2
	Multifamily	18,213	9,649	0	32.9
	Mobile Home	10,984	15,760	0	53.8
	Other	335	13,312	0	45.4
Gas and Electric	Single-Family	40,234	8,997	608	91.5
	Multifamily	1,798	6,415	300	51.9
	Mobile Home	573	8,153	599	87.7
	Other	957	8,040	n/a	n/a

SOURCE: 1. Puget Sound Energy, 2011; 2. U.S. Energy Information Agency: Residential Energy Consumption Survey, 2009.
Note: Multifamily refers to duplexes, triplexes and other multifamily units. 1000 kWh = 3.412 M-Btu; 1 therm = 0.100 M-Btu.

Applying the 10 and 30 percent reduction assumed for the Modest and Mighty scenarios gives the following energy use rates for the average dwelling unit (by type).

	Single-Family (M-Btu)	Multifamily (M-Btu)	Mobile Home (M-Btu)
Current	85.2	35.1	56.8
Baseline	85.2	35.1	56.8
Modest	76.7	31.6	51.1
Mighty	59.6	24.6	39.8

Since fewer than 10 percent of households in Thurston County use an alternative to electricity or natural gas for home heating[8], only these two energy sources were considered for modeling purposes.

Vehicle Miles Traveled (VMT) and Energy Use

All vehicles require a certain amount of energy to travel a mile in distance. Multiplying total VMT by this rate gives the total annual energy consumption for residential transportation. Vehicle fuel efficiency is the prmary driver of energy consumption in the transportation sector. More stringent CAFE standards and an increasing share of hybrid-electric and electric vehicles will drive the increase in average vehicle fuel efficiency in 2035.

Total Energy Consumption (Residential Transportation)
=
Total VMT × Energy per Mile Traveled

	Energy per Mile Traveled (k-Btu per Mile)	=	Energy Intensity of Gasoline (k-Btu / Gallon)	÷	Vehicle Fuel Efficiency (Miles / Gallon)
Current	**5.59**	=	114	÷	20.4
Baseline	**3.30**	=	114	÷	34.5
Modest	**3.30**	=	114	÷	34.5
Mighty	**3.30**	=	114	÷	34.5

SOURCE: Energy Information Administration: 2012 Annual Energy Outlook.

[8] U.S. Census Bureau, 2007-2011 American Community Survey

Forest Land Preservation – Additional Information

The table below shows an estimate of Forest Lands in Thurston County. The private forest lands in the Cities and unincorporated Urban Growth Area (UGA) are more vulnerable to development pressures than the forest lands in the rural areas

2010 Forest Land Inventory	Cities	UGA	Rural	Total
Total Forest Lands (acres)	**370**	**480**	**188,040**	**188,890**
Public Forest Lands	30	30	63,760	63,820
Private Forest Lands	340	450	124,280	125,070
Unlikely to convert to residential uses	*160*	-	*79,760*	*79,930*
Vulnerable to residential or commercial development	*170*	*450*	*44,520*	*45,140*

Farmland Preservation – Additional Information

The table below shows an estimate of Farmlands in Thurston County. The Farmlands in the Cities and unincorporated Urban Growth Area (UGA) are more vulnerable to development pressures than the farmlands in the rural areas. This is not an assessment of lands currently in use for farming or food production. The lands within the Open Space Agriculture Tax program are in agricultural uses. The Remaining Prime Farmlands are lands that are undeveloped or underdeveloped lands with soils that are suitable for farming based on the Natural Resources Conservation Service Land Capability Analysis (Tier 1 Soils).

2010 Farmland Inventory	Cities	UGA	Rural	Total
Total Farmlands (acres)	1,800	1,950	44,430	48,200
Unlikely to convert to residential development	90	330	14,330	14,700
Vulnerable to residential or commercial development	1,710	1,620	30,100	33,440
Within Open Space Agriculture tax program	660	830	21,020	22,500
Remaining Prime Farmlands	1,050	790	9,080	10,900

Note: The Thurston County Farmland Inventory defined approximately 68,250 acres of farmlands in 2009. The estimate in this report does not include forest lands with Tier 1 soil types as they were included in the forest land inventory. It is likely that this accounts for the majority of the difference between the two estimates.

Residential Carbon Dioxide Emissions – Additional Information

Within the Puget Sound Energy service area, approximately 1.08 pounds of CO_2 are emitted for every kilowatt-hour of electricity generated; statewide, the average is 0.36.pounds per kilowatt-hour.[9] Differences in methods and fuels used in generation (i.e., hyroelectricity versus natural gas combustion) explain the range of carbon intensities. For every therm of natural gas burned, 11.0 pounds of CO_2 are emitted.

Thurston County
Annual Residential CO_2 Emissions

PSE Customer Type	Structure Type	# Units[1]	Electricity[1] (kWh)	Natural Gas[2] (therms)	CO_2 (tons)
Electric Only	Single-Family	33,347	17,058	0	9.2
	Multifamily	18,213	9,649	0	5.2
	Mobile Home	10,984	15,760	0	8.5
	Other	335	13,312	0	7.2
Gas and Electric	Single-Family	40,234	8,997	608	8.2
	Multifamily	1,798	6,415	300	5.1
	Mobile Home	573	8,153	599	7.7
	Other	957	8,040	n/a	n/a

SOURCE: 1. Puget Sound Energy, 2011; 2. U.S. Energy Information Agency: Residential Energy Consumption Survey, 2009.
Note: Multifamily refers to duplexes, triplexes and other multifamily units. 1 kWh = 1.08 pounds CO_2; 1 therm = 11.0 pounds CO_2.

Applying the 10 and 30 percent reductions in the Energy Resource Scenarios gives the following rates of CO_2 emissions per household used in modeling.

	Single-Family (tons CO_2)	Multifamily (tons CO_2)	Mobile Home (tons CO_2)
Current	9.1	5.2	8.5
Baseline	9.1	5.2	8.5
Modest	8.19	4.68	7.65
Mighty	6.37	3.64	5.95

[9] Puget Sound Energy "Customer Handbook for Climate Change."
http://pse.com/aboutpse/Environment/Documents/4405_Climate_Change_Handbook.pdf

Vehicle Energy Use and CO_2 Emissions

To estimate CO_2 emissions, Vechicle Miles Traveled (VMT) is multiplied by the average amount of CO_2 emitted by driving a mile.

Total CO_2 Emissions (Residential Transportation)
=
Total VMT × CO_2 Emissions per Mile Traveled

	CO_2 per Mile Traveled (lbs. per Mile)	=	Energy Intensity of Gasoline (lbs. / Gallon)	÷	Vehicle Fuel Efficiency (Miles / Gallon)
Current	**0.966**	=	19.7	÷	20.4
Baseline	**0.571**	=	19.7	÷	34.5
Modest	**0.571**	=	19.7	÷	34.5
Mighty	**0.571**	=	19.7	÷	34.5

SOURCE: Energy Information Administration: 2012 Annual Energy Outlook.

Case Studies of

Water Efficiency in Thurston County

Thurston Regional Planning Council

December 2012

Summary

The Sustainable Thurston Task Force is considering strategies that could be implemented to sustain water resources as the region's population and climate changes in coming decades. State law requires water producers to adopt conservation practices to meet today's water needs without compromising the ability of future generations to meet their needs. This document analyzes water conservation and efficiency initiatives that Olympia, Lacey and Yelm have undertaken — including setting irrigation budgets, adjusting rates, installing meters and offering incentives to businesses and households.

State

The state Department of Health (DOH) adopted the Water Use Efficiency rule in 2007 in response to the state's municipal water law. The rule requires water suppliers to report publicly annual production, consumption and progress toward meeting measurable efficiency goals. At least one demand-side goal is required (e.g., cutting water consumption per capita). On the supply side, water suppliers must meet a standard of no more than 10 percent distribution system leakage on a rolling, three-year average. Leakage is water that cannot be accounted for (the gap between total production and authorized consumption). A 2012 survey shows that the top three measures Washington water suppliers use to promote efficiency with customers are public education, conservation rates and bills that show consumption history.[10] Eighty-eight percent of water suppliers have meters on all connections, and 74 percent have conservation rate structures.

Olympia

On July 11, 2007 the mercury rose to 99 degrees Fahrenheit and nary a drop of rain fell from the sky.[11] On this "peak" day, when folks used more water to beat the heat than any other day that year, Olympia's municipal utility produced 15.1 million gallons — enough to serve customers and fight a fire, if needed. Climate models project warmer winters with less snow and drier summers in the Pacific Northwest during the next century.[12] A warming, growing city will presumably consume more water — especially during summers — but Olympia has an aggressive conservation strategy to achieve its vision of a water supply that "sustains people in perpetuity while protecting the environment."

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[10] Partnership for Water Conservation. *Cooperative Conservation: A Report on the Implementation of Washington's Water Use Efficiency Rule*. 6 November 2012. Print.

[11] United States. Department of Commerce. National Oceanic and Atmospheric Administration. National Climate Data Center. *LCD Daily Form: 11 July 2006, Olympia Airport*. Washington, D.C. Online. Accessed 1 December 2012.

[12] Washington State. Department of Ecology. *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy*. April 2012. Online. Accessed 17 December 2012.

Olympia's *2009-2014 Water System Plan* projects that peak summer demand for water will more than double to 37.7 million gallons per day (mgd) by 2058. If the City succeeds in reducing its water consumption by 5 percent every six years, savings during the next 50 years would be about 2.1 million gallons per day.

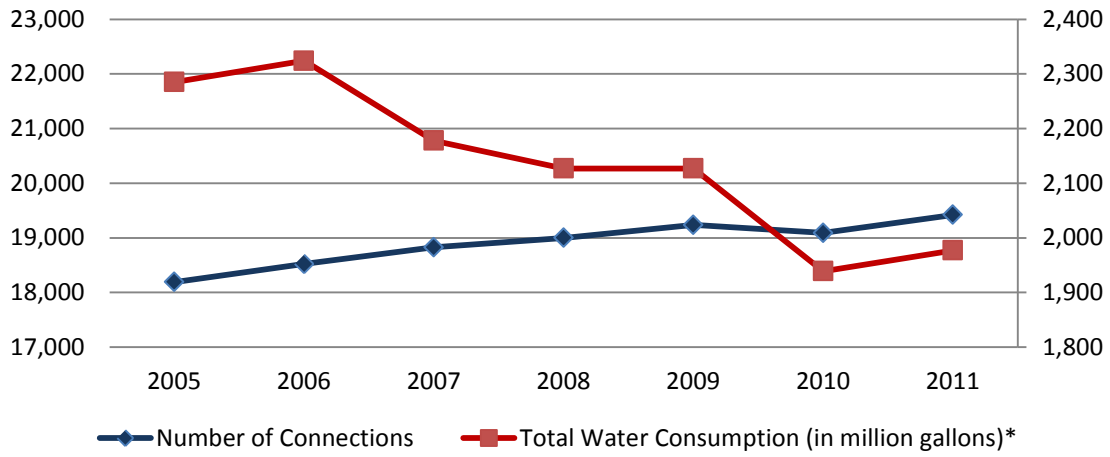
To achieve the plan's short-term goal of cutting water consumption by 5 percent by 2014, Olympia educates citizens about conservation, conducts water-loss accounting, repairs system leaks, and promotes the installation of efficient toilets that exceed code requirements. The City also offers households free water-saving kits and provides rebates for efficient washing machines and other technologies. If such initiatives are the carrot, then progressively hefty water bills are the stick.

> ***"The Utility sees itself as a steward of the water resource and therefore takes a broad view of the entire hydrologic cycle, rather than focusing narrowly on system infrastructure."***
>
> — **City of Olympia, 2009-2014 Water System Plan**

In 1997, Olympia introduced a three-tier rate structure for its single-family residential water customers, and the City added a fourth tier in 2005 to provide a stronger price signal. The "inclining block rate" structure means that the cost of water goes up along with usage (non-residential and multifamily customers are charged a seasonal water rate). Olympia is in the process of automating its system to enable officials to monitor meters remotely and fix leaks faster.

The conservation measures, along with recent summer weather patterns (people use less water during rainy summers), appear to be affecting consumer behavior, officials contend. The City is on pace to surpass its 2009-2014 conservation goal: Water consumption declined by more than 13 percent between the start of 2005 and end of 2011 as water connections increased almost 7 percent (Figure 1). Distribution system leakage in 2011 was 6.1 percent, down from 8.8 percent in 2007.[13] During the 2009-2011 period, the leakage average was 7.2 percent; water consumption declined 7 percent.

Figure 1: Olympia Conservation Versus Connections, 2005-2011



***Includes commercial and residential customers; does not include historical PUD consumption**

Source: City of Olympia Public Works Department

[13] Washington State. Department of Health. *Water Use Efficiency Performance Report (Olympia, 2007 & 2011)*. Online. Accessed 1 Dec. 2012.

Olympia's water conservation efforts were highlighted in an article by the HarvestH20.com, an online publication dedicated to sustainable water-management practices.[14] The article noted several "lessons learned" from the efforts:

- Repeat rationale for conservation in as many venues as possible;
- Target different programs to different audiences;
- Partner with others in the community who share your conservation vision.

Lacey

In 2006, fast-growing Lacey adopted a resolution that prohibits new water connections within its urban growth area unless the property owner or developer has sufficient water rights and transfers them to the City. Six years later, Lacey is considering lifting the resolution's restraints as part of changes to the City's draft *Water Comprehensive Plan*. The move comes after the state Department of Ecology in July 2012 issued Lacey water permits for 6.6 million gallons a day to meet anticipated demand from building out its service area to planned densities that are required by the state Growth Management Act.

To help balance growth and consumption going forward, Lacey has the region's broadest array of water-conservation measures. Lacey offers each residential customer an indoor water-saving kit that includes toilet leak-detection tablets, faucet aerators and a high-efficiency showerhead. Residential customers are also eligible for a free high-efficiency toilet and shower timer, as well as a cash rebate for buying a high-efficiency washing machine.

To save water outside, the City offers residential customers a free kit with hose screens, repair ends and an adjustable spray nozzle. Other giveaways to households include a soil moisture sensor and timer that shuts off hose sprinklers. Commercial customers are eligible for a free irrigation audit and rebates for implementing system upgrades recommended in the audit. Commercial customers that have received an audit — most of whom are homeowner associations (HOAs) — are saving about 25 percent more water, on average.

All Lacey water customers must follow an outdoor irrigation schedule to reduce summer peak demand. Addresses ending with an odd number may water yards on Saturdays, Mondays and Wednesdays; addresses ending with an even number may water outdoors on Sundays, Tuesdays and Thursdays. Exceptions include watering plants in pots and greenhouses, as well as washing vehicles.

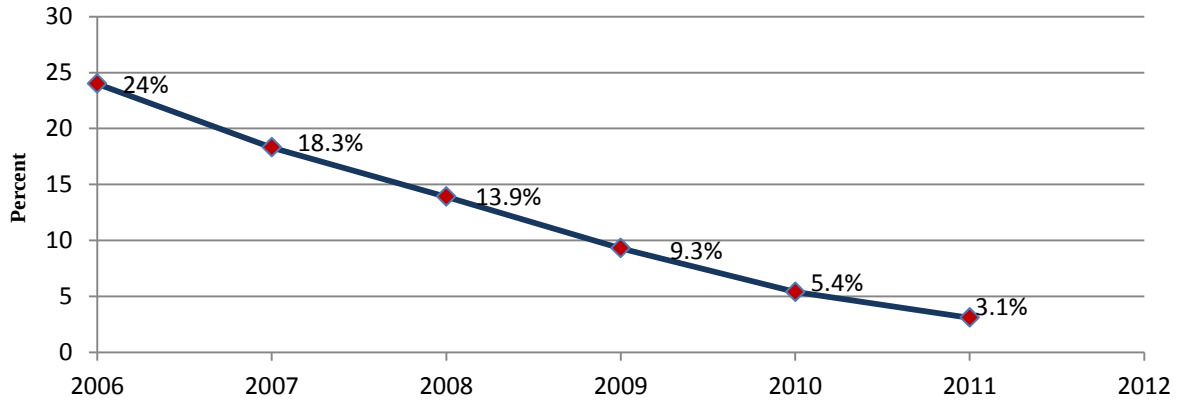
Lacey implemented a four-tier rate structure for water customers in 2007. The City also adopted a 6.5 percent water rate increase annually through 2017 — part of the water plan's strategy to reduce water use by 690,000 gallons a day by 2015. The strategy also includes reducing and maintaining the distribution system leakage to less than 10 percent, as well as reducing annual equivalent residential unit water demand for all accounts by 1 percent each year through 2014, to a value of 199 gallons a day.

Lacey's water use is forecast to grow from 9.2 mgd in 2015 to 11.6 mgd in 2029; peak demand would grow from 20.3 mgd in 2015 to 25.5 mgd in 2029.

[14] Pushard, Doug. "Local Heros: City of Olympia Water Conservation Program Covers All Bases." *HarvestH$_2$0*. May 2005. Online. Accessed 1 Dec. 2012.

Lacey is already achieving the plan's goals. The City has slashed system leakage to about 3 percent by reducing water theft and automating meters, as well as by implementing state-of-the-art leak-detection and line-replacement programs (Figure 2). Officials read automated meters twice a day remotely and are able to detect and fix leaks faster. Officials have also placed roughly 300 locks on hydrants at schools, construction sites and spots hidden from public view; developers are now provided hydrant meters rather than charged a flat rate for water use at dusty construction sites.

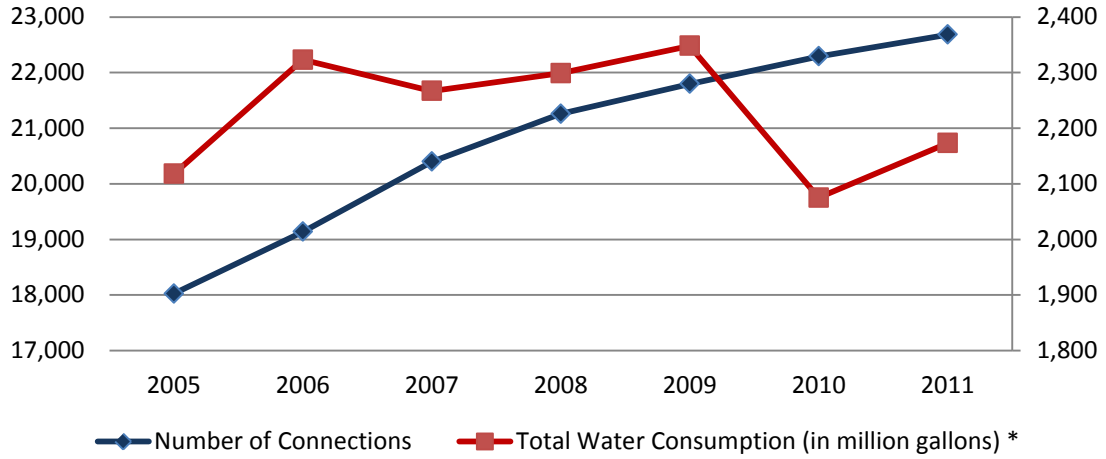
Figure 2: Lacey Distribution System Leakage (Unaccounted for Water), 2006-2011



Source: City of Lacey Public Works Department

In 2011, Lacey water customers consumed an average of 169 gallons a day, per equivalent residential unit (the City's new measuring stick for water consumption); this figure marked a 20 percent decrease from the baseline of 210 gpd.[15] Water consumption rose roughly 3 percent between the start 2005 and end of 2011 as water connections increased 26 percent (Figure 3). Officials attributed the sharp decline between 2009 and 2010 to the implementation of a fourth tier of water rates, a very mild summer, and the purchase of calibration equipment at all of Lacey's 19 source meters; the new equipment indicated that the meters were over-reporting water use historically. Each meter is now calibrated on a regular basis, resulting in more accurate reporting.

Figure 3: Lacey Conservation Versus Connections, 2005-2011



*Includes total meter sales for commercial and residential customers; does not include distribution system leakage.
Source: City of Lacey Public Works Department

[15] Washington State. Department of Health. *Water Use Efficiency Performance Report (Lacey, 2011)*. Online. Accessed 1 Dec. 2012.

Yelm

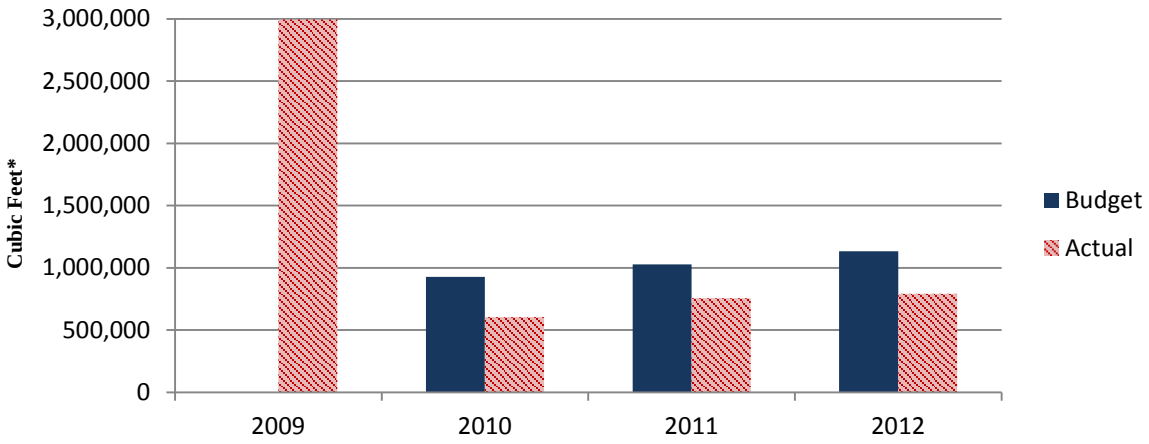
In April 2010, the Yelm City Council adopted a conservation program that established a water budget for businesses and homeowners associations with an irrigation meter. The 2010 irrigation budget was based on either the commercial customers' irrigation volume in 2009 or what the Washington Irrigation Guide (WIG) notes is needed for healthy and productive landscaping in Yelm (11.53 inches of irrigation water per season for trees/shrubs) — whichever was less. The goal was to cut in half the growing city's 2009 irrigation volume — nearly 3 million cubic feet (about 22.4 million gallons).

Here's how the irrigation budget worked for two of Yelm's biggest water consumers: WalMart and the Yelm Terra Homeowners Association, which represents the neighborhood immediately south of downtown. The WalMart Superstore near the intersection of State Routes 507 and 510 has about 52,300 square feet of landscaping and consumed about 204,600 cf of water for irrigation in 2009. Applying the WIG formula, Yelm calculated that the superstore's landscaping requires roughly 50,200 cf (390,000 gallons) of water — about a quarter of the water consumed in 2009 — to be healthy and productive. Thus, the 2010 budget slashed WalMart's consumption by about 154,600 cf (1.2 million gallons). The city saved another 47,000 cf (352,000 gallons) of water by applying the WIG formula to the Yelm Terra HOA.

Yelm has cut its irrigation volume by roughly a third while growing its population by a third since 2009.

Citywide, Yelm's water use for commercial irrigation — about 602,700 cf (4.5 million gallons) — was 35 percent below its 2010 budget of roughly about 926,700 cf (6.9 million gallons).[16] Water use for commercial irrigation was 27 percent below budget in 2011 and 30 percent below budget in 2012 (Figure 4). The commercial landscape figures above do not include storm ponds and planter strips in the public right-of-way.

Figure 4: Yelm Commercial Irrigation Budget and Consumption, 2009-2012



* 1 cubic foot equals 7.5 gallons

Source: City of Yelm Community Development Department

City officials read commercial customers' meters weekly during the irrigation season (mid-April thru mid-October) and provide notice of usage. A customer's irrigation meter is locked when the annual water budget is reached. Planting strips in the public right-of-way are irrigated with reclaimed water. The water budgets have made businesses and HOAs more mindful that every drop counts — especially in Thurston County's fastest-growing city.

[16] Beck, Grant. "Irrigation." Message to author. 4 Dec. 2012. E-mail.

Yelm and its urban growth area are projected to add roughly 18,000 people and 7,200 housing units between 2010 and 2035.[17] In addition to issuing Lacey water permits last summer, the state Department of Ecology approved a permit that allows Yelm to receive rights to an additional 840,000 gallons of water a day. The permit is under appeal to the Washington State Pollution Control Hearings Board, which is anticipated to issue a decision in January 2013. If the permit is upheld, it would provide water sufficient for anticipated growth during the next two decades and avoid the need for a building moratorium.

Like the other communities, Yelm has achieved its goal of reducing residential water consumption — in the latter city's case, to no more than 200 gallons a day. In 2011, the typical single-family home in Yelm used 170 gallons a day, down 3 percent from 2010.[18] Demand-side conservation measures include public education and incentives — including providing tablets that detect toilet leaks.

As Yelm has raised commercial and residential water efficiency, the City's distribution system leakage rate remains stubbornly high. Yelm has set a goal of limiting its leakage rate to 6 percent on a rolling, three-year average. Yelm's average for the 2009-2011 period was 20.9 percent — more than twice the state standard. To identify and halt water losses, Yelm has expanded its leak-detection program, installed hydrant locks, performed annual meter calibration programs, conducted a system audit, and completed a water loss control action plan in accordance with state law.

Conclusion

Olympia, Lacey and Yelm have significantly increased their water use efficiency with a diverse portfolio of water rates, incentives and budgets. Some of the water-saving devices and rebates were made possible by the LOTT Clean Water Alliance, which has invested about $7 million during the past 15 years to promote conservation in the communities of Lacey, Olympia, Tumwater and Thurston County.[19] LOTT's investment has reduced pressure on water supplies and postponed the need to build additional sewer capacity.

Lacey and Olympia's tiered rate structures send powerful price signals to households and spur less consumption. Yelm's irrigation budget enforces efficient water use and enables new development within the urban growth area. Such sustainability strategies are a critical and replicable form of climate change adaptation — which The World Bank defines as "a process by which measures and behaviors to prevent, moderate, cope with and take advantage of the consequences of climate events are planned, enhanced, developed and implemented."[20] Indeed, a recent state Department of Ecology report on climate change recommends that local governments improve water management by promoting integrated conservation and efficiency approaches that consider future water supply and address competing water demands.[21]

Water use efficiency is an important hedge against climate change.

[17] Thurston Regional Planning Council. *Population Forecast Allocations for Thurston County (draft)*. September 2012.
[18] Washington State. Department of Health. *Water Use Efficiency Performance Report (Lacey, 2011)*. Online. Accessed 1 Dec. 2012.
[19] Dodge, John. "LOTT water conservation reduces pressure on Olympia drinking-water supplies." *The Olympian*. 7 August 2012. Online. Accessed 4 Dec. 2012.
[20] The World Bank. *Climate Change: Adaptation Guidance Notes — Key Words and Definitions*. Online. Accessed 4 Dec. 2012.
[21] Washington State. Department of Ecology. *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy*. April 2012. Online. Accessed 17 December 2012.