AGRICULTURE WATER DEMAND MODEL

Capital Regional District

November 2019

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AGRICULTURE WATER DEMAND MODEL

Report for Capital Regional District

November 2019

Authors:

Stephanie Tam, P.Eng.

Water Management Engineer
British Columbia Ministry of Agriculture
Innovation and Adaption Services Branch
Abbotsford, B.C.

Ted van der Gulik, P.Eng.

President
Partnership for Water Sustainability in British Columbia
Abbotsford, B.C.

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The authors would like to thank Capital Regional District staff for providing the photo for the report cover. The photo was taken from the west side of Mount Douglas in Saanich, showing urban farming at the base of the mountain.

1. Background

The Agriculture Water Demand Model (AWDM or "Model") was first developed in the Okanagan Watershed. It was initiated in response to rapid population growth, drought conditions from climate change, and the overall increased demand for water. Many of the watersheds in British Columbia (B.C.) are fully allocated already or may be in the next 15 to 20 years. The AWDM helps to understand current agricultural water use and to fulfil the Province's commitment under the "*Living Water Smart – BC Water Plan*" to reserve water for agricultural lands. The Model can be used to establish agricultural water reserves throughout the various watersheds in B.C. by providing current and future agricultural water use data.

Climate change scenarios developed by the University of British Columbia (UBC) and the Summerland Research and Development Centre predict an increase in agricultural water demand due to warmer and longer summers and lower precipitation during summer months in the future.

The Model provides current and future agricultural water demands. It calculates water use on a property-by-property basis, and sums each property to obtain a total water demand for the entire basin or each sub-basin. Data on crop type, irrigation system type, soil texture and climate are used to calculate the water demand. Climate data from year 2003 was used to represent the highest water demands in one of the hottest and driest years on record, and year 1997 climate data was used to represent the water demand in a wet year. Lands within the Agriculture Land Reserve (ALR) in Capital Regional District (CRD) are shown in green in Figure 1.

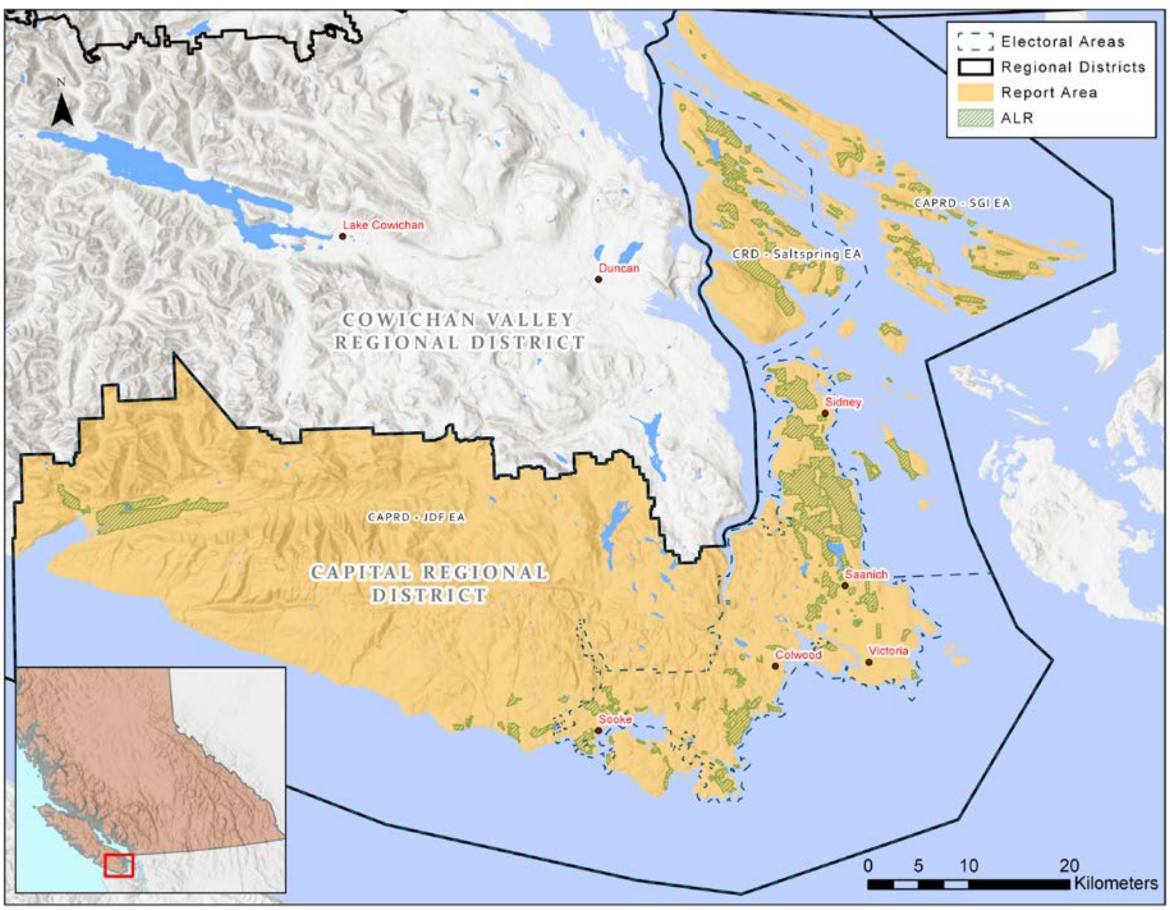

Figure 1 Map of Capital Regional District

2. Methodology

The Model is based on a Geographic Information System (GIS) database that contains data on crop type, irrigation system type, soil texture and climate. An explanation of how the data is compiled for each variable is provided in this section. Figure 2 shows the surveyed area including all properties within the ALR and areas that were zoned for agriculture by the local governments. The survey was conducted by the Ministry of Agriculture (AGRI) staff, and professional contractors and summer students hired by the Ministry of Agriculture.

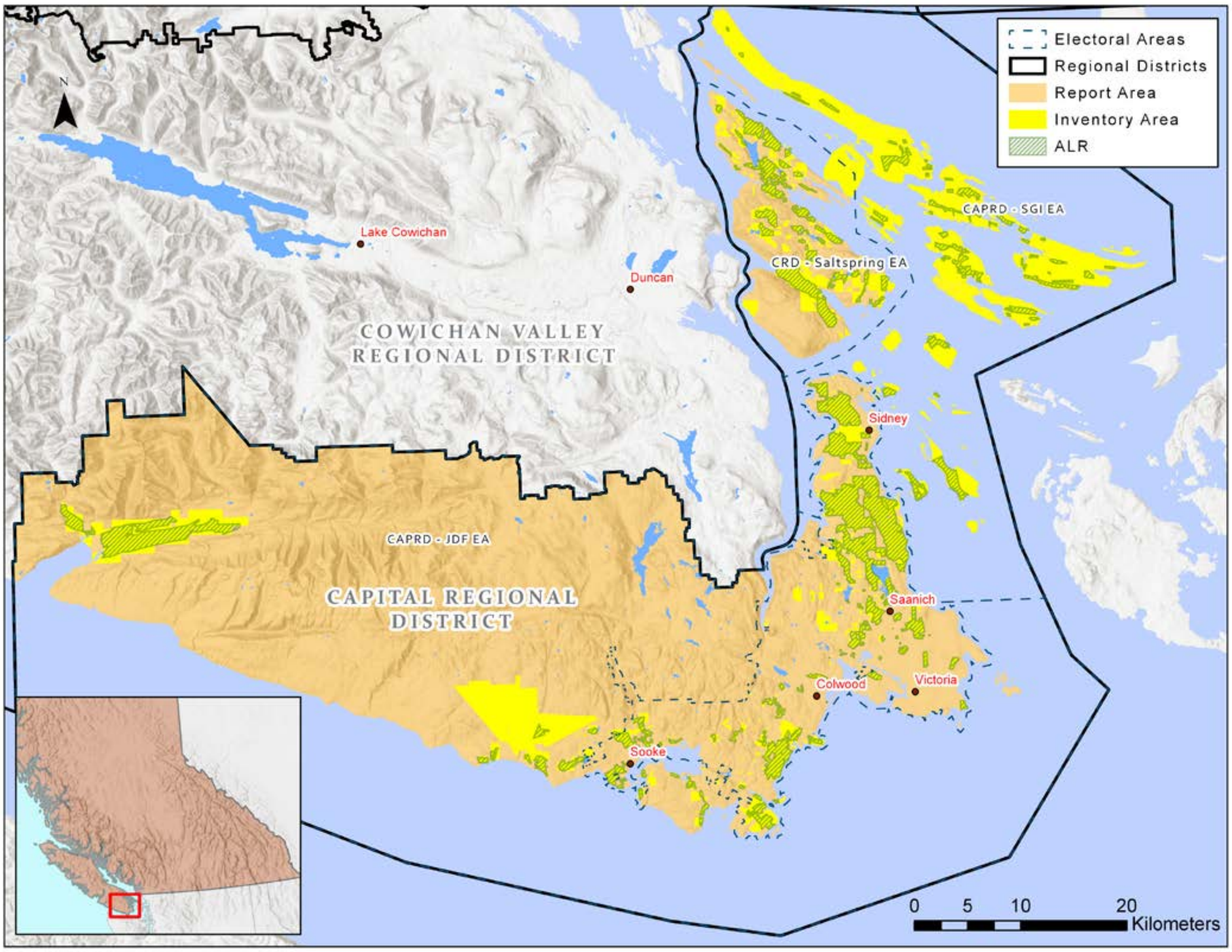

Figure 2 Map of the Surveyed Area

2.1. Cadastre and Polygon

Cadastre data was provided by the Integrated Cadastral Information Society (ICIS). All of the cadastre data was unified into one seamless cover for the entire project area. This process allows the Model to calculate water demand for each parcel and to report out on sub-basins, local governments, water purveyors or aquifers by summing the data for those areas. Aerial photographs were used to conduct an initial review of crop type by cadastre. Within each cadastre, permanent physical structures (e.g., farmstead and driveways) were separated from cropping areas by creating new polygons, and excluded from the calculation of water demand. If the difference in crop type could be identified on the aerial photographs, the polygon would be split so each new polygon would contain a unique crop type. This data was entered in the GIS land use database that was used by the field crew to conduct and complete the Agricultural Land Use Inventory (ALUI).

2.2 Agricultural Land Use Inventory (ALUI)

The survey crew uses the land use database created to verify data about each property. Surveys were done in the summer of 2018. The survey crew drove by each property where the database was checked for accuracy using visual observation and the aerial photographs on the survey maps. A Professional Agrologist with local knowledge verified what was on the site, and a GIS technician altered the codes in the database as necessary. When the survey was completed for the entire project area, post-survey data quality control was conducted to ensure the additional polygons were accurately entered into the database.

The smallest unit for which water use is calculated are the polygons within each cadastre. A polygon is determined by a change in crop type or irrigation system type within a cadastre. Polygons are designated as blue lines within each cadastre as shown in Figure 3 which provides an enhanced view of a cadastre containing three polygons. Each cadastre has a unique identifier as does each polygon. The polygon identifier is acknowledged by PolygonID. This allows the survey team to call up the cadastre in the database, review the number of polygons within the cadastre and ensure the land use is coded accurately for each polygon.

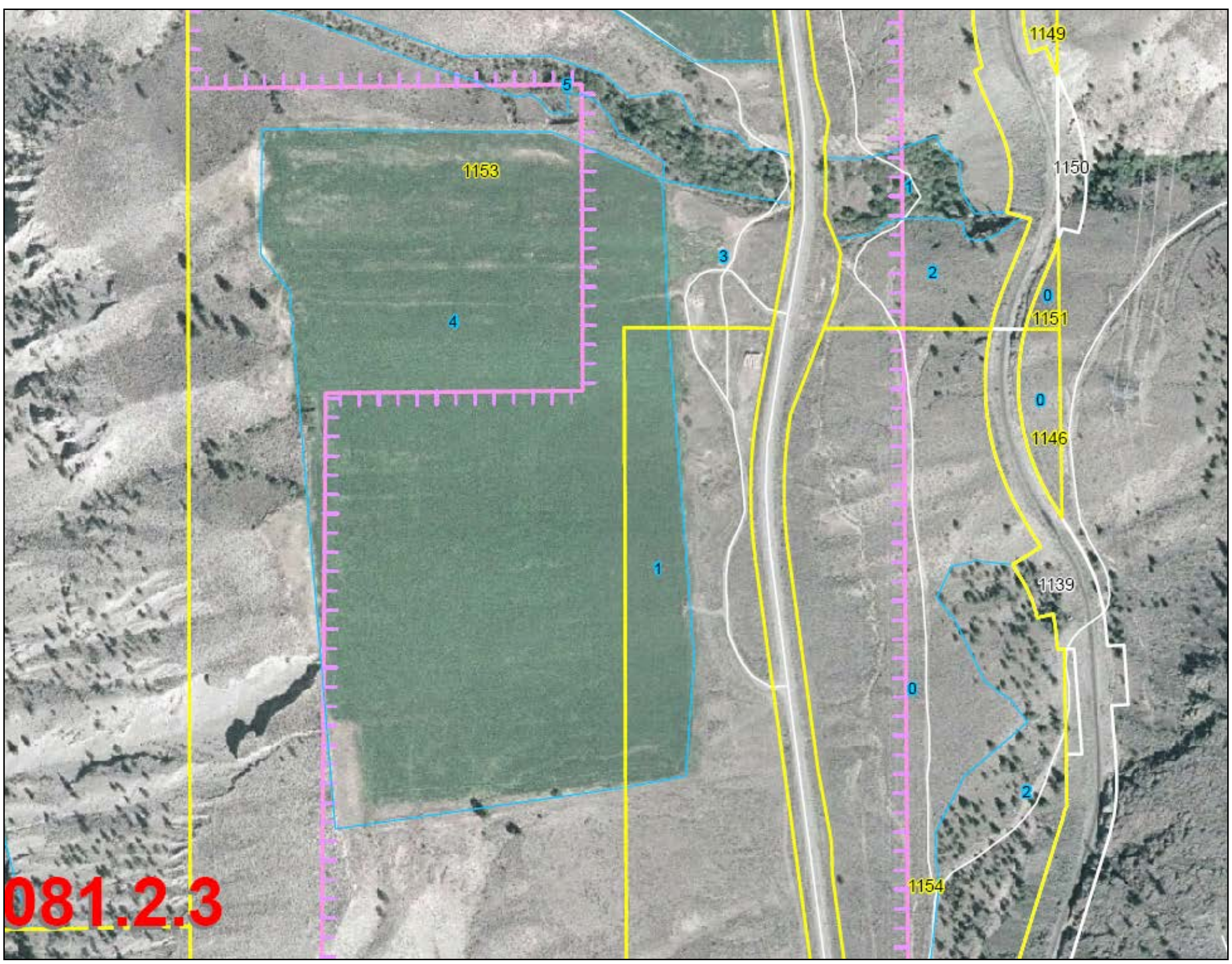

Figure 3 Cadastre with Polygons

2.3 Soil Information

Soil data was obtained digitally from the British Columbia Ministry of Environment. Soil attributes required for this project was the soil texture, the available water storage capacity, and the peak infiltration rate for each texture type.

The intersection of soil boundaries with the cadastre and land use polygons creates additional polygons that the Model uses to calculate water demand. Figure 4 shows how the land use information is divided into additional polygons using the soil boundaries. The Model calculates water demand using every different combination of crop, soil and irrigation system as identified by each polygon.

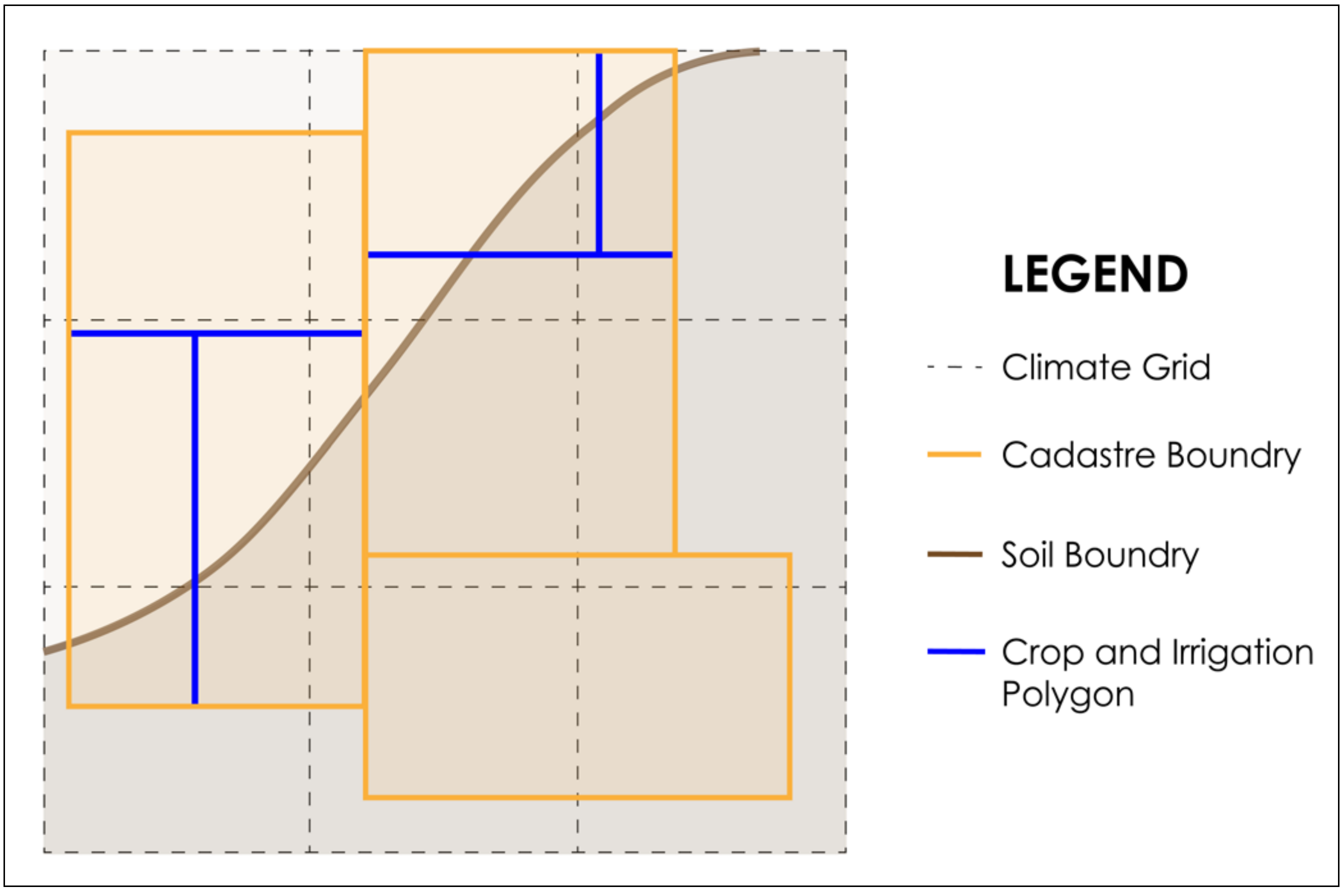

Figure 4 Polygon Attributes

2.4 Climate Information

The agricultural water demand is calculated using climate data, crop type, irrigation system type and soil texture. The climate generally gets cooler and wetter from south to north and as elevation increases. To incorporate the climatic diversity, climate layers were developed for the entire Province on a 500 metre by 500 metre grid. Each grid cell contains daily climate data, minimum and maximum temperature (Tmin and Tmax), and precipitation all of which allow the Model to calculate a daily reference evapotranspiration rate (ETo) value. A range of agro-climatic indices such as growing degree days (GDD), corn heat units (CHU), frost free days and temperature sum (T-sum) can also be calculated for each grid cell based on temperature data. These values are used to determine seeding dates and the length of the growing season in the Model.

The climate dataset has been developed by using data collected from climate stations across the Province from 1961 to 2010. This climate dataset was then interpolated to provide a climate data layer for the entire Province on the 500 metre by 500 metre grid. The climate grid cell that is prominent for a cadastre boundary is assigned to that cadastre. Additional polygons are not generated with the climate grid.

The attributes attached to each climate grid cell include:

- Latitude
- Longitude
- Elevation
- Aspect
- Slope
- Daily Precipitation
- Daily T_{min} and T_{max}

A climate database contains Tmin, Tmax, Tmean and Precipitation for each day of the year from 1961 until 2010. The parameters that need to be selected, calculated and stored within the Model are evapotranspiration (ETo), T-sum, effective precipitation (EP), frost free days, first frost date, GDD with base temperatures of 5 oC and 10 oC, and CHU. These climate and crop parameters are used to determine the growing season length as well as the beginning and end of the growing season in Julian day.

3. Model Calculations

The Model calculates the water demand for each polygon by using crop type, irrigation system type, soil texture and climate data as explained below. Each polygon was assigned an ID number as mentioned previously.

3.1 Crop

The CropID is an attribute of the PolygonID as each polygon contains a single crop. The crop information is collected (as observed during the land use survey) and stored with the PolygonID. CropID provides cropping attributes to the Model for calculating water use for each polygon. CropID along with the climate data is also used to calculate the growing season length and the beginning and end of the growing season. The attributes for CropID include rooting depth, availability coefficient, crop coefficient and a drip factor.

- Rooting depth is the rooting depth for a mature crop in a deep soil.
- An availability coefficient is assigned to each crop. The availability coefficient is used with the IrrigID to determine the soil moisture available to the crop for each PolygonID.
- The crop coefficient adjusts the calculated ET_o for the stages of crop growth during the growing season. Crop coefficient curves have been developed for every crop. The crop coefficient curve allows the Model to calculate water demand with an adjusted daily ET_o value throughout the growing season.
- The drip factor is used in the water use calculation for polygons where drip irrigation systems are used. Since the Model calculates water use by area, the drip factor adjusts the percentage of area irrigated by the drip system for that crop.

3.2 Irrigation

The IrrigID is an attribute of the PolygonID as each polygon has a single irrigation system type operating. The irrigation system type is collected (as observed during the land use survey) and stored with the PolygonID. The land use survey determines if a polygon has an irrigation system operating, what the system type is, and if the system is being used. The IrrigID contains an irrigation efficiency listed as an attribute.

Two of the IrrigID, Overtreedrip and Overtreemicro are polygons that have two systems in place. Two irrigation IDs occur when an overhead irrigation system has been retained to provide crop cooling or frost protection. In this case, the efficiency factors for drip and microsprinkler are used in the Model.

3.3 Soil

The digitized soil database came from the British Columbia Ministry of Environment. In addition, soil data provided by Agriculture and Agri-Food Canada (AAFC) was also used to generate multiple soil layers within each polygon. Each parcel was assigned the most predominant soil polygon, and then for each crop field within that soil polygon, the most predominant texture within the crop's rooting depth was determined and assigned to the crop field.

Note that textures could repeat at different depths. The combined total of the thicknesses determined the most predominant texture. For example, a layer of 20 cm sand, followed by 40 cm clay and then 30 cm of sand would have sand be designated at the predominant soil texture.

The attributes attached to the SoilID is the Available Water Storage Capacity (AWSC) which is calculated using the soil texture and crop rooting depth.

The Maximum Soil Water Deficit (MSWD) is calculated to decide the parameters for the algorithm that is used to determine the Irrigation Requirement (IR). The Soil Moisture Deficit (SMD) at the beginning of the season is calculated using the same terms as the MSWD.

3.4 Climate

The climate data in the Model is used to calculate a daily reference evapotranspiration rate (ETo) for each climate grid cell. The data that is required to calculate this value are:

- Elevation, metres (m)
- Latitude, degrees (^{o})
- Minimum Temperature, degree Celsius (^{o}C)
- Maximum Temperature, degree Celsius (^{o}C)
- Classification as Coastal or Interior
- Classification as Arid or Humid
- Julian Day

Data that is assumed or are constants in this calculation are:

• Wind speed	2 m/s
• Albedo or canopy reflection coefficient,	0.23
• Solar constant, G_{sc}	0.082 $MJ^{-2}min^{-1}$
• Interior and Coastal coefficients, K_{Rs}	0.16 for interior locations 0.19 for coastal locations
• Humid and arid region coefficients, K_o	0 °C for humid/sub-humid climates 2 °C for arid/semi-arid climates

4. Livestock Water Use

Livestock type was observed and recorded during the land use survey as listed in Table 1. Livestock scale was also observed and entered into the database: very small, small, medium, large, very large, and very very large. The Model calculates an estimated livestock water demand using the livestock scale observed. Water use for each animal type is calculated differently depending on requirements. For example, for a dairy milking cow, the water demand for each animal includes, drinking, preparation for milking, pen and barn cleaning, milking system washout, bulk tank washout and milking parlor washing. However, for a dry dairy cow, the demand only includes drinking and pen and barn cleaning.

The water use is estimated on a daily basis per animal even though the facility is not cleaned daily. For example, for a broiler operation, the water use for cleaning a barn is calculated as 4 hours of pressure washing per cycle at a flow rate of 10 gallons per minute (gpm), multiplied by 6 cycles per barn with each barn holding 50,000 birds. On a daily basis, this is quite small with a value of 0.01 Litres per day per bird applied.

For all cases, the daily livestock water demand is applied to the farm location. However, in the case of beef, the livestock spend parts of the year on the range. Since the actual location of the animals cannot be ascertained, the water demand is applied to the home farm location, even though most of the demand will not be from this location. Therefore, the animal water demand on a watershed scale will work well, but not when the demand is segregated into sub-watersheds or groundwater areas.

The estimates used for each livestock are shown in Table 1.

Table 1 Livestock Water Demand (Litres/day)

Animal Type	Drinking	Milking Preparation	Barn Component	Total
Milking Dairy Cow	65	5	15	85
Dry Cow	45		5	50
Swine	12		0.5	12.5
Poultry – Broiler	0.16		0.01	0.17
Poultry – Layer	0.08		0.01	0.09
Turkeys	0.35		0.01	0.36
Goats	8			8
Sheep	8			8
Beef – range, steer, bull, heifer	50			50
Horses	50			50

5. Report Area

The Capital Regional District (CRD) encompasses the thirteen municipalities of Greater Victoria and three unincorporated areas: Juan de Fuca Electoral Area on Vancouver Island, Salt Spring Island (SSI) Electoral Area, and Southern Gulf Islands (SGI) Electoral Area (Figure 5).

Note: This report is focused on all areas within the CRD <u>except</u> for SSI and SGI Electoral Areas. Please refer to separate reports for SSI and SGI.

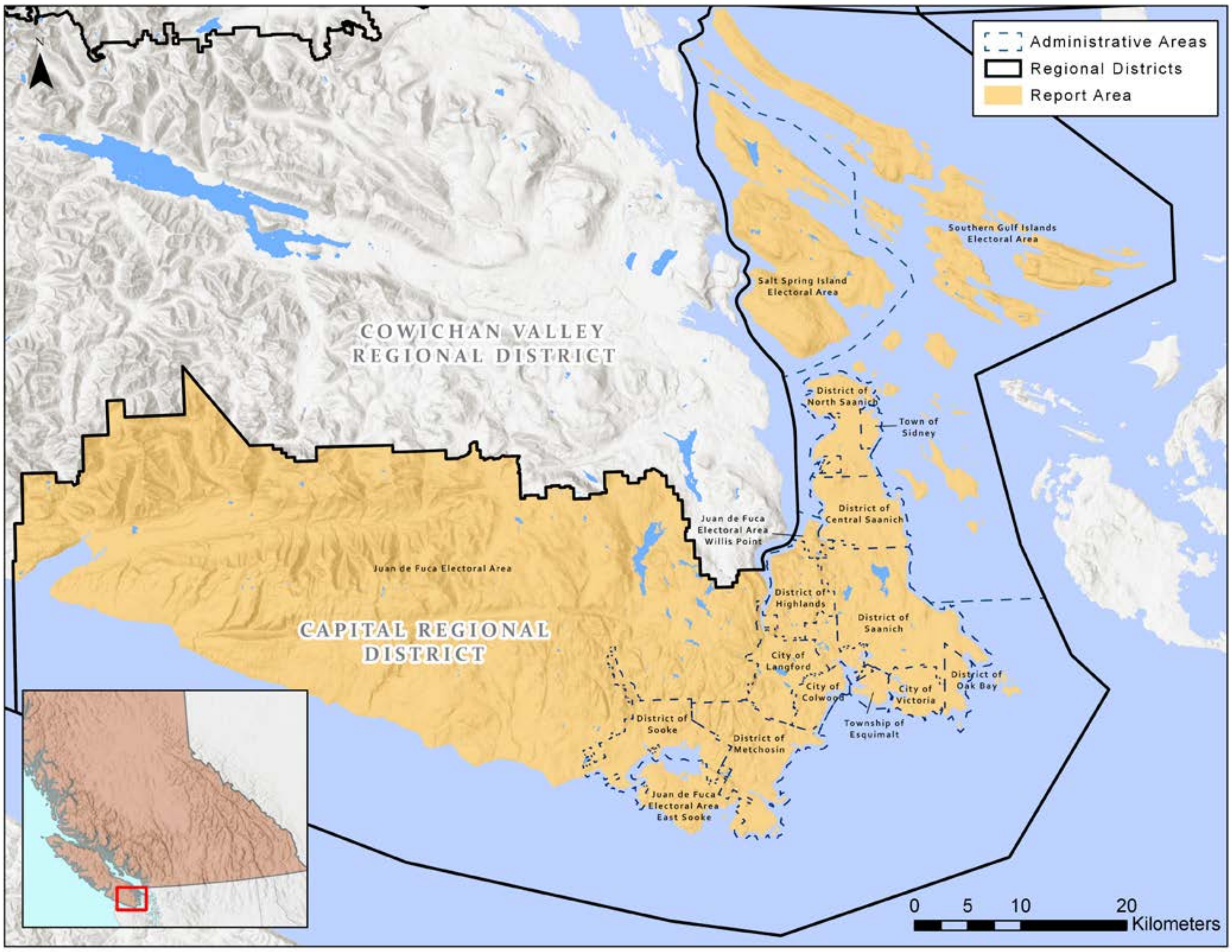

Figure 5 Administrative Areas in Capital Regional District

6. Agricultural Water Demand Results

Note: This report is focused on all areas within CRD <u>except</u> for SSI and SGI Electoral Areas. Please refer to separate reports for SSI and SGI.

The Agriculture Water Demand Model (AWDM or "Model") can generate modelled results using a series of pre-developed scenarios. The Appendix in this report includes summary tables of the modelled results. Climate data from years 1997 and 2003 were chosen as they represent a relatively wet year and dry year respectively. Most results in this report are based on climate data from year 2003 which represents the maximum water demand. Results using climate change scenarios in years 2053, 2056 and 2059 are also presented.

6.1 Annual Crop Water Demand – Tables A and B

The Model offers a selection of three irrigation management factors: good, average and poor. Unless otherwise noted, average management was used in the tables. Appendix Table A provides the annual irrigation water demand based on the crop and irrigation systems observed in the survey year, year 2003 climate data, and average irrigation management. Table B provides the same data for year 1997 climate data.

Where a crop cannot be determined, a forage crop is defaulted to the irrigated area to enable to Model to calculate a water demand value. The total irrigated acreage in CRD is 995 hectares (ha), including 407 ha of forage, and 322 ha of vegetable. In CRD, 520 ha is supplied by licensed surface water sources, and 474 ha is irrigated with groundwater. Although groundwater licensing is required under the Water Sustainability Act (WSA) as of February 29, 2016, no or minimal groundwater licences were issued since then in the project area. Parcels that were observed to have irrigation were assumed to obtain water from aquifers if surface water licences do not exist and that the parcel is not purveyed by the local government.

The total annual irrigation demand was 7,369,673 m^3 in 2003, and dropped to 4,103,475 m^3 in 1997. During a wet year like 1997, the demand was only 55% of a hot dry year like 2003.

6.2 Annual Water Demand by Irrigation System – Table C

The irrigation demand can also be summarized by irrigation system type as shown in Table C. The more efficient irrigation system for vegetable is drip (including overtreedrip) which irrigates 187 ha in the project area, and for forage is low-pressure pivots which are used on 6.7 ha in this area. There is also a large portion of the forage irrigated by less efficient sprinkler systems (including travelling guns, wheeline and handline). Sprinkler, wheeline, handline and travelling guns irrigate 712 ha (70%) of the agricultural crops.

6.3 Annual Water Demand by Soil Texture – Table D

The Model calculates water demand on a property by property basis and can summarize the data for each soil texture as shown in Table E. Where soil texture data is missing, the soil texture has been defaulted to sandy loam, i.e., "Sandy Loam (defaulted)".

6.4 Annual Water Demand by Subbasin – Table E

The Model calculates water demand on a property by property basis and can summarize the data for each subbasin as shown in Table E.

6.5 Annual Water Demand by Water Purveyor – Table F

The Model calculates water demand on a property by property basis and can summarize the data for each water purveyor as shown in Table F. The CRD is the main water purveyor as it provides water to the local governments in the area.

6.6 Annual Water Demand by Local Government – Table G

The Model calculates water demand on a property by property basis and can summarize the data for irrigated area within each local government as shown in Table G.

6.7 Irrigation Management Factors – Table H

The Model can estimate water demand based on poor, average and good irrigation management factors. This is accomplished by developing an irrigation management factor for each crop type, soil texture and irrigation system type combination based on subjective decision and percolation rates. The Maximum Soil Water Deficit (MSWD) is the maximum amount of water that can be stored in the soil within the crop's rooting zone. An irrigation system applying more water than what can be stored will result in percolation beyond the crop's rooting depth. Irrigation systems (e.g., a stationary gun) with high application rates will have a probability of higher percolation rates.

For each soil texture class, a range of four MSWD are provided to reflect a range of crop's rooting depths. An irrigation management factor, which determines the amount of leaching, is established for each of the MSWD values for the soil textures. The management factor is based on irrigation expertise as to how the various irrigation systems are able to operate. For example, Table 2 indicates that for a loam soil and a MSWD of 38 mm, a solid set overtree system has a management factor of 0.10 for good management while the drip system has a management factor of 0.05. This indicates that it is easier to prevent percolation with a drip system than it is with a solid set sprinkler system. For poor management, the factors are higher.

There are a total of 1,344 irrigation management factors established for the 16 different soil textures, MSWD and 21 different irrigation system combinations used in the Model.

The management factors increase as the MSWD decreases because there is less soil storage potential in the crop rooting depth. For irrigation systems such as guns, operating on a pasture which has a shallow rooting depth, on a sandy soil which cannot store much water, the poor irrigation management factor may be as high as 0.50.

The management factor used in the Model assumes all losses are deep percolation while it is likely that some losses will occur as runoff as well.

Table 2 Irrigation Management Factors							
Soil Texture	**MSWD**	**Solid Set Overtree**			**Drip**		
		Good	**Average**	**Poor**	**Good**	**Average**	**Poor**
Loam	38	0.10	0.15	0.20	0.05	0.10	0.15
	50	0.05	0.10	0.15	0.05	0.075	0.10
	75	0.05	0.10	0.15	0.05	0.075	0.10
	100	0.05	0.075	0.10	0.05	0.075	0.10
Sandy loam	25	0.20	0.225	0.25	0.10	0.15	0.20
	38	0.10	0.15	0.20	0.10	0.125	0.15
	50	0.05	0.10	0.15	0.05	0.10	0.10
	75	0.05	0.10	0.15	0.05	0.075	0.10

Table H provides an overview of the impacts on the irrigation management factors and irrigation systems used. Since a large portion of the crops in the region are forage crops most of which are currently irrigated with sprinkler systems, the impacts of improved management are not significant (5.8% in total water use reduction between poor and good management). Improved management for sprinkler systems during the peak of the season is limited as the systems often will be operating on a 24-hour per day basis. A further reduction could be achieved by improving irrigation efficiencies as shown in Table I.

This table also provides percolation rates based on good, average and poor management using 2003 climate data. In summary, good management is 7,160,125 m^3, average is 7,369,673 m^3 and poor management is 7,579,222 m^3. Percolation rates for poor management are 44% higher than for good management.

6.8 Deep Percolation – Table I

The percolation rates vary by crop type, irrigation system type, soil texture, and irrigation management factor used. Table I shows the deep percolation amounts by irrigation system type for average management. The last column provides a good indication of the average percolation per hectare for the various irrigation system types. For example, drip irrigation systems have only about 73% of the percolation rates of gun systems.

6.9 Improved Irrigation Efficiency and Good Management – Table J

There is an opportunity to reduce water use by converting irrigation systems to a higher efficiency for some crops. For example, drip systems could be used for all fruit crops, vegetable crops and some of the other horticultural crops, but not forage crops. In addition, using better management such as irrigation scheduling techniques will also reduce water use, especially for forage where drip conversion is not possible. Table J provides a scenario of water demand if all sprinkler systems are converted to drip systems for horticultural crops in the project area, as well as converting irrigation systems to low-pressure pivot systems for forage fields over 10 ha, using good irrigation management. In this case, the water demand for 2003 would reduce from 7,369,673 m^3 to 6,314,200 m^3 (14% reduction).

6.10 Livestock Water Use – Table K

The Model provides an estimate of water use for livestock. The estimate is based on the number of animals in the project area as determined by the latest census, the drinking water required for each animal per day and the barn or milking parlour wash water. Values used are shown in Table K. For the project area, the amount of livestock water is estimated at 61,694 m^3.

6.11 Crop Water Demand with Climate Change (Year 2050s Climate) for High Demand Years Using Surveyed Crops and Irrigation Systems and Good Management – Table L

The Model also has access to climate change information until the year 2100. While data can be run for each year, three driest years in the 2050s were selected to give a representation of climate change. Figure 6 shows the climate change results which indicate 2053, 2056, and 2059 generate the highest annual ET_o and lowest annual precipitation. Therefore, these three years were used in this report. Table L provides the results of climate change on irrigation demand for the three years selected using crop types and irrigation system types captured in the land use survey. Surveyed crop and irrigation system types were used to show the increase due to climate change alone, with no other changes taking place.

Figure 7 shows all of the climate change scenario runs for the Okanagan using 12 climate change models from year 1960 to 2100. This work was compiled by Denise Neilsen at the Agriculture and Agri-Food Canada – Summerland Research and Development Centre. There is a lot of scatter in this figure, but it is obvious that there is a trend of increasing water demand.

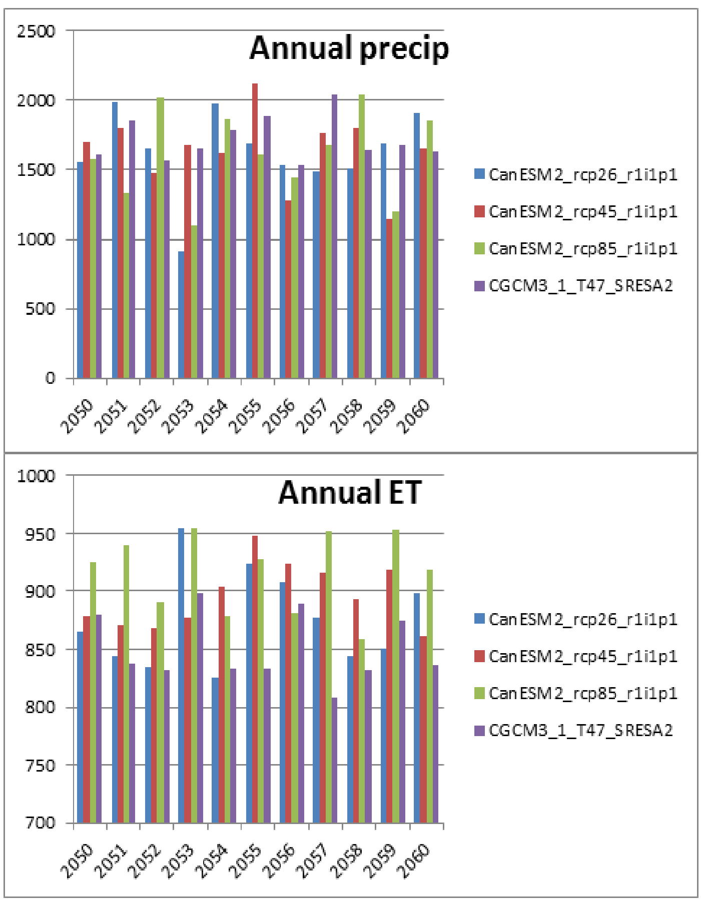

Figure 6 Annual ET and Effective Precipitation in Year 2050s

The three climate change models used in this report are access1 rcp85, canESM2 rcp85 and cnrm-cm5 rcp85. Running only three climate change models on three selected future years in the project area is not sufficient to provide a trend like in Figure 7. What the results do show is that in an extreme climate scenario, it is possible to have an annual water demand that is 19% higher than what was experienced in year 2003 based on canESM2 rcp85 climate model in year 2053. More runs of the climate change models will be required to better estimate a climate change trend for the region.

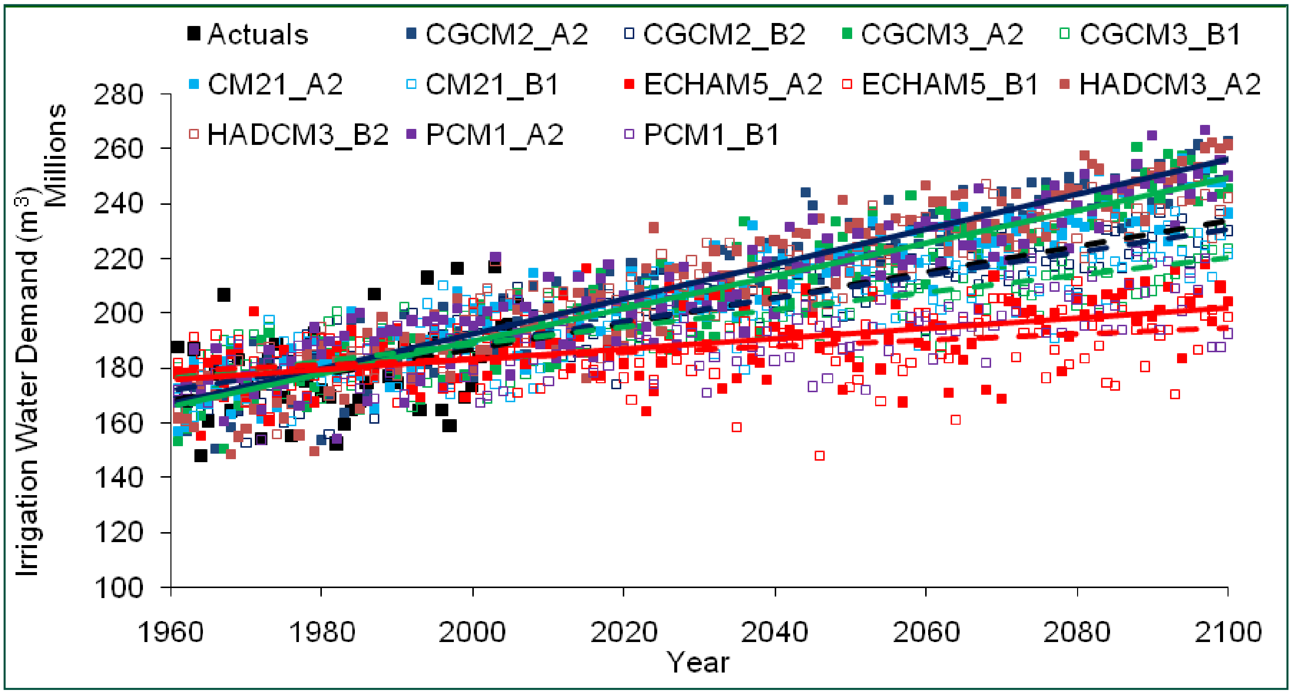

Figure 7 Future Irrigation Demand for All Outdoor Uses in the Okanagan in Response to Observed Climate Data (Actuals) and Future Climate Data Projected from a Range of Global Climate Models

6.12 Water Demand by Crop with Buildout, Year 2003 Climate, and Good Management – Table M

An agricultural irrigated buildout scenario was developed that looked at potential agricultural lands that could be irrigated in the future. The rules used to establish where potential additional agricultural lands were located are as follows:

- within 1,000 m of water supply (lake)
- within 1,000 m of water supply (water course)
- within 1,000 m of water supply (wetland)
- within 1,000 m of high productivity aquifer
- within 1,000 m of water purveyor
- within 125 m elevation from the surface water source to the property
- with Ag Capability class 1-4 only where available
- must be within the ALR
- below 750 m average elevation
- must be private ownership

Permanent physical structure (e.g., farmstead, houses, driveways) are not considered to be available for the buildout scenario. For the areas that are determined to be eligible for future buildout, a crop type and irrigation system type need to be applied. Where a crop already exists in the land use inventory, that crop would remain and an irrigation system type assigned. If no crop exists, then a crop type and an irrigation system type would be assigned as per the criteria below:

- 40% berries and kiwi – 100% drip
- 25% forage – 40% sprinkler, 40% travelling gun, and 20% low-pressure centre pivot
- 25% vegetables – 100% drip
- 10% grapes – 100% drip

Figure 8 indicates the location of agricultural land that is currently irrigated (blue) and the land that can be potentially irrigated (red). Based on the scenario provided for the project area, the additional agricultural land that could be irrigated is 3,087 ha, which is an increase in irrigated acreage of 303%. The water demand for a year like 2003 would then be about almost 19 million m3 assuming efficient irrigation systems and good management.

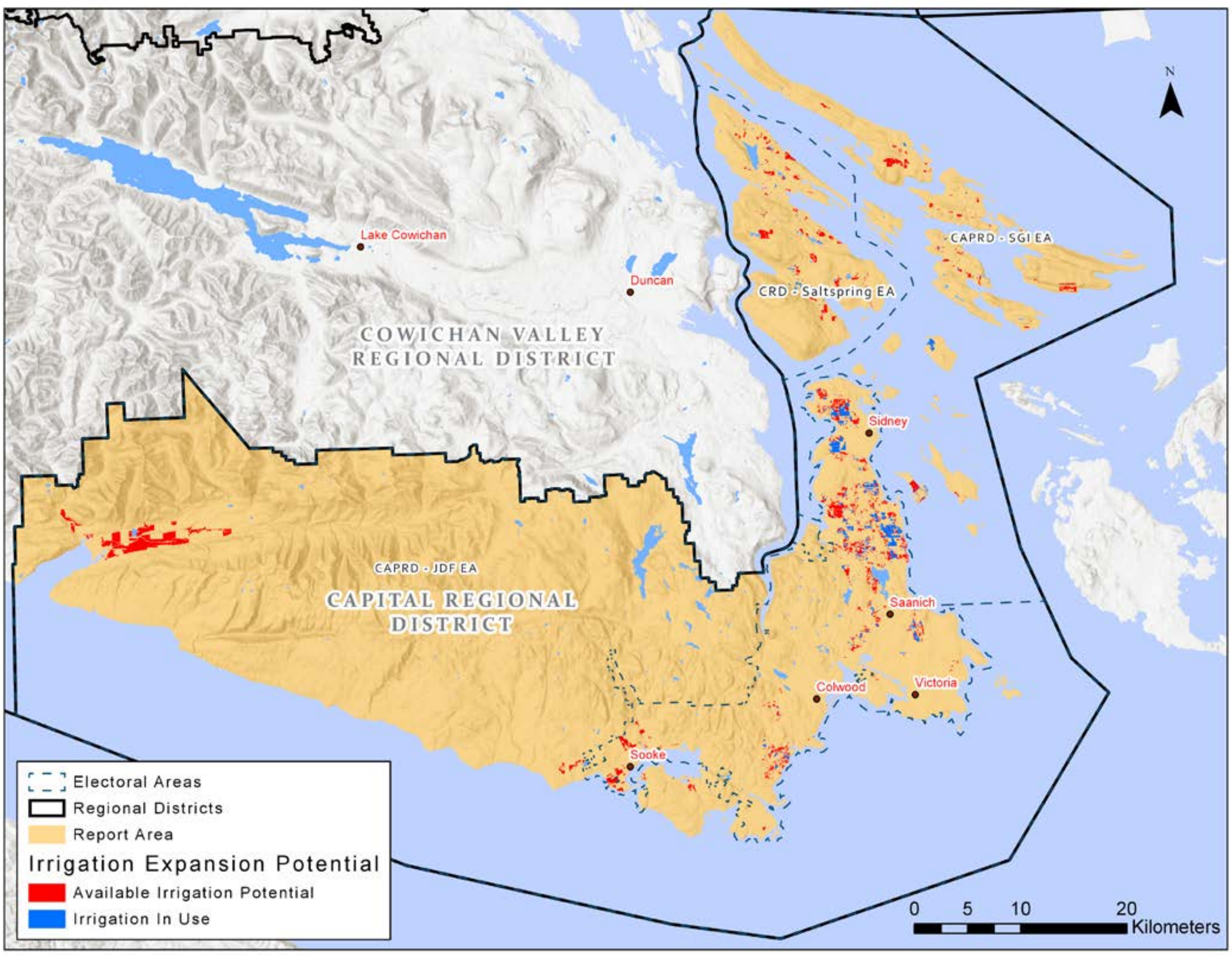

Figure 8 Irrigation Expansion Potential for the Project Area

6.13 Crop Water Demand with Buildout, Climate Change (Year 2050s Climate for High Demand Years), and Good Management – Table N

The same irrigation expansion and cropping scenario used to generate the values in Table L were used to generate the water demand with climate change as shown in Table N. See discussion under Table L section. When climate change is added to the buildout scenario, the water demand increases from 8.7 million m^3 to 24 million m^3 (a further 177% increase) based on climate change model canESM2 rcp85 in Year 2053 using the highest potential scenario.

6.14 Water Demand by Irrigation System with Buildout, Year 2003 Climate, and Good Management – Table O

Table O provides an account of the irrigation systems used by area for the buildout scenario in the previous two examples. Note that pivot irrigation (especially low-pressure type) is expected to be used for forage field over 10 ha in size to be economically feasible.

6.15 Water Demand by Soil Texture with Buildout, Year 2003 Climate, and Good Management – Table P

Table O provides the water demand by soil type for the buildout scenario used in this report. Comparing these values with the result in Table D will provide information on the possible increased water demand by soil type for the projected irrigated areas.

6.16 Water Demand by Subbasin with Buildout, Year 2003 Climate, and Good Management – Table Q

Table Q provides the water demand by subbasin for the buildout scenario used in this report. Comparing these values with the result in Table E will provide information on the possible increased water demand in each subbasin for the projected irrigated areas.

6.17 Water Demand by Water Purveyor with Buildout, Year 2003 Climate, and Good Management – Table R

Table R provides the water demand by water purveyor for the buildout scenario used in this report. Comparing these values with the result in Table F will provide information on the possible increased water demand by each water purveyor for the projected irrigated areas.

6.18 Water Demand by Local Government with Buildout, Year 2003 Climate, and Good Management – Table S

Table S provides the water demand by local government for the buildout scenario used in this report. Comparing these values with the result in Table G will provide information on the possible increased water demand in each local government for the projected irrigated areas.

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Appendix Tables

Appendix Table A Water Demand by Crop Using Year 2003 Climate and Average Management

Appendix Table B Water Demand by Crop Using Year 1997 Climate and Average Management

Appendix Table C Water Demand by Irrigation System Using Year 2003 Climate and Average Management

Appendix Table D Water Demand by Soil Texture Using Year 2003 Climate and Average Management

Appendix Table E Water Demand by Subbasin Using Year 2003 Climate and Average Management

Appendix Table F Water Demand by Water Purveyor Using Year 2003 Climate and Average Management

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Appendix Table H Management Comparison on Irrigation Demand and Percolation Volumes Using Year 2003 Climate

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Appendix Table J Water Demand by Crop Using Improved Irrigation System Efficiency, Year 2003 Climate, and Good Management

Appendix Table K Water Demand by Animal Type Using Year 2003 Climate

Appendix Table L Crop Water Demand with Climate Change (Year 2050s Climate for High Demand Years) Using Surveyed Crops and Irrigation Systems and Good Management

Appendix Table M Water Demand by Crop with Buildout, Year 2003 Climate, and Good Management

Appendix Table N Crop Water Demand with Buildout, Climate Change (Year 2050s Climate for High Demand Years), and Good Management

Appendix Table O Water Demand by Irrigation System with Buildout, Year 2003 Climate, and Good Management

Appendix Table P Water Demand by Soil with Buildout, Year 2003 Climate, and Good Management

Appendix Table Q Water Demand by Subbasin with Buildout, Year 2003 Climate, and Good Management

Appendix Table R Water Demand by Water Purveyor with Buildout, Year 2003 Climate, and Good Management

Appendix Table S Water Demand by Local Government with Buildout, Year 2003 Climate, and Good Management

Appendix Table A. Water Demand by Crop Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Crop Group	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Apple	10.5	67,352	641	0	0	0	12.5	89,236	711	23.1	**156,588**	679
Berry	59.4	296,396	499	0	0	0	8.5	38,361	449	67.9	**334,756**	493
Cherry	1.3	8,705	664	0	0	0	0	0	0	1.3	**8,705**	664
Corn	28.1	223,057	794	0	0	0	48.3	365,047	755	76.4	**588,104**	769
Forage	179.5	1,558,526	868	0	0	0	227.4	1,954,999	860	406.9	**3,513,525**	863
Fruit	1.1	9,946	944	0	0	0	0.4	3,330	779	1.5	**13,275**	896
Grape	14.6	59,608	407	0	0	0	16.1	69,139	430	30.7	**128,746**	419
Nursery	27.7	229,776	828	0	0	0	26.7	210,638	790	54.4	**440,414**	810
Nursery Floriculture	6.7	40,772	610	0	0	0	3.6	20,440	571	10.3	**61,212**	597
Vegetable	191.4	1,052,336	550	0	0	0	130.8	806,830	617	322.3	**1,859,166**	577
	520.3	**3,546,473**	682	0	**0**	0	474.4	**3,558,019**	750	1,019.70	**7,369,673**	723

Appendix Table B. Water Demand by Crop Using Year 1997 Climate and Average Management

Year: 1997	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Crop Group	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**
Apple	10.5	36,504	347	0	0	0	12.5	49,370	394	23.1	**85,874**	373
Berry	59.4	147,458	248	0	0	0	8.5	18,924	221	67.9	**166,382**	245
Cherry	1.3	4,854	370	0	0	0	0	0	0	1.3	**4,854**	370
Corn	28.1	112,497	400	0	0	0	48.3	182,649	378	76.4	**295,146**	386
Forage	179.5	872,394	486	0	0	0	227.4	1,086,377	478	406.9	**1,958,771**	481
Fruit	1.1	5,607	532	0	0	0	0.4	1,804	422	1.5	**7,410**	500
Grape	14.6	23,480	161	0	0	0	16.1	27,315	170	30.7	**50,795**	165
Nursery	27.7	113,760	410	0	0	0	26.7	103,198	387	54.4	**216,958**	399
Nursery Floriculture	6.7	19,050	285	0	0	0	3.6	9,617	269	10.3	**28,668**	279
Vegetable	191.4	575,395	301	0	0	0	130.8	462,079	353	322.3	**1,037,474**	322
	520.3	**1,911,000**	367	0	**0**	0	474.4	**1,941,332**	409	1,019.70	**4,103,475**	402

Appendix Table C. Water Demand by Irrigation System Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Irrigation System	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Drip	82.9	424,778	512	0	0	0	22.8	117,589	516	105.7	**542,367**	513
Gun	6.6	47,106	715	0	0	0	0	0	0	6.6	**47,106**	715
Handline	13.2	85,073	644	0	0	0	34.8	298,683	857	48.1	**383,756**	798
Microspray	1.4	9,606	675	0	0	0	0	0	0	1.4	**9,606**	675
Microsprinkler	3.3	22,560	682	0	0	0	2.7	21,643	800	6	**44,203**	735
Overtreedrip	51.2	283,692	554	0	0	0	30.4	154,647	509	81.6	**438,340**	537
Pivot	0	0	0	0	0	0	27.9	196,031	702	27.9	**196,031**	702
PivotLP	6.7	56,882	854	0	0	0	0	0	0	6.7	**56,882**	854
SDI	0.7	3,291	448	0	0	0	0	0	0	0.7	**3,291**	448
Sprinkler	52.9	433,919	820	0	0	0	61.6	496,221	806	114.4	**930,140**	813
Ssovertree	38.7	292,263	756	0	0	0	30.8	234,235	761	69.4	**526,499**	758
Sssprinkler	3.1	23,025	746	0	0	0	0	0	0	3.1	**23,025**	746
Ssundertree	0.9	5,645	623	0	0	0	3.2	25,175	784	4.1	**30,820**	748
Subirrig	0	0	0	0	0	0	1.3	6,298	475	1.3	**6,298**	475
Travgun	268.2	1,994,226	744	0	0	0	238.7	1,853,646	777	506.8	**3,847,871**	759
Wheelline	7.5	50,024	671	0	0	0	28.4	233,415	823	35.8	**283,439**	792
	537.2	**3,732,091**	695	0	**0**	0	482.5	**3,637,583**	754	1,019.70	**7,369,673**	723

Appendix Table D. Water Demand by Soil Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Soil Texture	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Cultured Medium	16.9	185,618	1,100	0	0	0	8.1	79,564	985	24.9	**265,181**	1,063
Loam	0	0	0	0	0	0	4.5	37,270	824	4.5	**37,270**	824
Loamy Sand	14.8	117,402	796	0	0	0	22.8	160,866	706	37.5	**278,268**	742
Organic	27.6	160,567	582	0	0	0	11.7	70,253	598	39.3	**230,821**	587
Sand	0.6	5,066	873	0	0	0	1.2	14,019	1,178	1.8	**19,086**	1,078
Sandy Loam	135.6	911,897	673	0	0	0	68.7	513,203	748	204.2	**1,425,100**	698
Sandy Loam (defaulted)	0.7	8,017	1,169	0	0	0	0.4	4,967	1,372	1	**12,984**	1,239
Silt Loam	106.2	695,326	655	0	0	0	115.1	907,367	788	221.3	**1,602,693**	724
Silty Clay Loam	234.9	1,648,197	702	0	0	0	250.1	1,850,074	740	485	**3,498,272**	721
	537.2	**3,732,091**	695	0	**0**	0	482.5	**3,637,583**	754	1,019.70	**7,369,673**	723

Appendix Table E. Water Demand by Subbasin Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Subbasin	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Unknown	442.3	3,080,176	696	0	0	0	423	3,222,308	762	865.3	**6,302,484**	728
Ayum Creek	0	0	0	0	0	0	0.2	1,074	636	0.2	**1,074**	636
Bilston Creek	8.9	82,926	930	0	0	0	17.8	128,192	721	26.7	**211,119**	791
Colquitz River	73.8	480,762	652	0	0	0	27.7	185,092	667	101.5	**665,853**	656
Craigflower Creek	0	0	0	0	0	0	0.2	1,358	819	0.2	**1,358**	819
De Mamiel Creek	0.3	2,024	628	0	0	0	0	205	1,224	0.3	**2,229**	658
Gillspie Creek	0	0	0	0	0	0	3.6	25,111	692	3.6	**25,111**	692
Jacob Creek	0	0	0	0	0	0	0.2	473	295	0.2	**473**	295
King Creek	0.5	1,979	427	0	0	0	0.9	4,098	452	1.4	**6,077**	444
Sooke River	0.4	4,116	933	0	0	0	1.1	7,363	650	1.6	**11,479**	729
Tod Creek	11	80,107	728	0	0	0	7.8	62,309	795	18.8	**142,416**	756
	537.2	**3,732,091**	695	0	**0**	0	482.5	**3,637,583**	754	1,019.70	**7,369,673**	723

Appendix Table F. Water Demand by Water Purveyor Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Water Purveyor	Irrigated Area (ha)	Irrigation Demand (m³)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m³)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m³)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m³)	Avg.Req. (mm)
District Of North Saanich	103.3	887,626	860	0	0	0	0	0	0	103.3	**887,626**	860
The Corporation Of The District Of Central Saanich	174.3	1,051,691	603	0	0	0	0	0	0	174.3	**1,051,691**	603
The Corporation Of The District Of Saanich	64.9	455,503	702	0	0	0	0	0	0	64.9	**455,503**	702
	342.5	**2,394,819**	699	0	**0**	0	0	**0**	0	342.5	**2,394,819**	699
Tsartlip	2.9	25,514	893	0	0	0	0	0	0	2.9	**25,514**	893
	2.9	**25,514**	893	0	**0**	0	0	**0**	0	2.9	**25,514**	893
Private	191.9	1,311,758	684	0	0	0	482.5	3,637,583	754	674.4	**4,949,340**	734
	191.9	**1,311,758**	684	0	**0**	0	482.5	**3,637,583**	754	674.4	**4,949,340**	734
	537.2	**3,732,091**	695	0	**0**	0	482.5	**3,637,583**	754	1,019.70	**7,369,673**	723

Appendix Table G. Water Demand by Local Government Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Local Government	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**
Capital Regional District	0.5	1,979	427	0	0	0	4.6	29,610	640	5.1	**31,590**	621
City Of Langford	1	3,886	396	0	0	0	4.6	23,827	520	5.6	**27,713**	498
District Of Highlands	0	0	0	0	0	0	0.2	1,358	819	0.2	**1,358**	819
District Of Metchosin	10.6	94,588	889	0	0	0	37.4	285,570	764	48	**380,158**	792
District Of North Saanich	133	1,131,393	851	0	0	0	163.5	1,345,671	823	296.5	**2,477,064**	835
District Of Sooke	0.8	6,140	804	0	0	0	1.4	8,713	626	2.2	**14,854**	689
The Corporation Of The District Of Central Saanich	282.5	1,754,563	621	0	0	0	212.9	1,545,788	726	495.5	**3,300,351**	666
The Corporation Of The District Of Saanich	106	714,028	674	0	0	0	57.2	396,563	693	163.2	**1,110,590**	680
Town Of View Royal	0	0	0	0	0	0	0.7	482	69	0.7	**482**	69
Tsartlip	2.9	25,514	893	0	0	0	0	0	0	2.9	**25,514**	893
	537.2	**3,732,091**	695	0	**0**	0	482.5	**3,637,583**	754	1,019.70	**7,369,673**	723

Appendix Table H. Irrigation Management Comparison on Water Demand and Percolation Volume Using Year 2003 Climate

	Water Source									Crop Irrigation Total			
	Surface Water			Reclaimed Water			Groundwater						
Irrigation Management	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Perc. (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Perc. (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Perc. (m^3)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Deep Perc. (m^3)**	**Perc. Rate (m^3/ha)**
Poor	537.2	**3,836,369**	480,620	0	**0**	0	482.5	**3,742,853**	467,912	1,019.70	7,579,222	948,532	930
Average	537.2	**3,732,091**	376,342	0	**0**	0	482.5	**3,637,583**	362,641	1,019.70	7,369,673	738,983	725
Good	537.2	**3,627,812**	272,064	0	**0**	0	482.5	**3,532,312**	257,371	1,019.70	7,160,125	529,435	519

Appendix Table I. Percolation Volume by Irrigation System Using Year 2003 Climate and Average Management

Year: 2003	Water Source									Total			
	Surface Water			Reclaimed Water			Groundwater						
Irrigation System	Irrigated Area (ha)	Irrigation Demand (m^3)	Deep Perc. (m^3)	Irrigated Area (ha)	Irrigation Demand (m^3)	Deep Perc. (m^3)	Irrigated Area (ha)	Irrigation Demand (m^3)	Deep Perc. (m^3)	Irrigated Area (ha)	Irrigation Demand (m^3)	Deep Perc. (m^3)	Perc. Rate (m^3/ha)
Drip	82.9	424,778	55,908	0	0	0	22.8	117,589	16,347	105.7	**542,367**	72,254	684
Gun	6.6	47,106	6,152	0	0	0	0	0	0	6.6	**47,106**	6,152	932
Handline	13.2	85,073	8,131	0	0	0	34.8	298,683	31,378	48.1	**383,756**	39,509	821
Microspray	1.4	9,606	1,231	0	0	0	0	0	0	1.4	**9,606**	1,231	879
Microsprinkler	3.3	22,560	4,520	0	0	0	2.7	21,643	5,086	6	**44,203**	9,606	1,601
Overtreedrip	51.2	283,692	30,850	0	0	0	30.4	154,647	16,516	81.6	**438,340**	47,366	580
Pivot	0	0	0	0	0	0	27.9	196,031	16,095	27.9	**196,031**	16,095	577
PivotLP	6.7	56,882	6,561	0	0	0	0	0	0	6.7	**56,882**	6,561	979
SDI	0.7	3,291	427	0	0	0	0	0	0	0.7	**3,291**	427	610
Sprinkler	52.9	433,919	43,342	0	0	0	61.6	496,221	53,499	114.4	**930,140**	96,841	847
Ssovertree	38.7	292,263	30,795	0	0	0	30.8	234,235	20,193	69.4	**526,499**	50,988	735
Sssprinkler	3.1	23,025	2,638	0	0	0	0	0	0	3.1	**23,025**	2,638	851
Ssundertree	0.9	5,645	774	0	0	0	3.2	25,175	2,509	4.1	**30,820**	3,284	801
Subirrig	0	0	0	0	0	0	1.3	6,298	631	1.3	**6,298**	631	485
Travgun	268.2	1,994,226	175,362	0	0	0	238.7	1,853,646	176,863	506.8	**3,847,871**	352,224	695
Wheelline	7.5	50,024	9,652	0	0	0	28.4	233,415	23,525	35.8	**283,439**	33,177	927
	537.2	**3,732,091**	376,342	0	**0**	0	482.5	**3,637,583**	362,641	1,019.70	**7,369,673**	738,983	725

Appendix Table J. Water Demand by Crop Using Improved Irrigation System Efficiency, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Crop Group	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Apple	10.5	55,015	523	0	0	0	12.5	65,103	519	23.1	**120,118**	521
Berry	59.4	286,628	483	0	0	0	8.5	37,379	438	67.9	**324,007**	477
Cherry	1.3	8,388	639	0	0	0	0	0	0	1.3	**8,388**	639
Corn	28.1	214,499	763	0	0	0	48.3	358,460	742	76.4	**572,959**	750
Forage	179.5	1,425,496	794	0	0	0	227.4	1,796,455	790	406.9	**3,221,951**	792
Fruit	1.1	9,744	925	0	0	0	0.4	3,179	744	1.5	**12,924**	872
Grape	14.6	57,701	394	0	0	0	16.1	66,839	416	30.7	**124,539**	405
Nursery	27.7	223,610	806	0	0	0	26.7	205,467	771	54.4	**429,078**	789
Nursery Floriculture	6.7	40,123	601	0	0	0	3.6	20,037	560	10.3	**60,160**	587
Vegetable	191.4	719,538	376	0	0	0	130.8	455,357	348	322.3	**1,174,895**	365
	520.3	**3,040,743**	584	0	**0**	0	474.4	**3,008,276**	634	1,019.70	**6,314,200**	619

Appendix Table K. Water Demand by Animal Type Using Year 2003 Climate

Year: 2003	Water Demand (m3)
Animal Type	
Beef	10,922
Dairy - dry	3,848
Dairy - milking	10,004
Goats	1,840
Horses	9,617
Poultry - broiler	6,416
Poultry - laying	3,397
Sheep	13,016
Swine	2,634
	61,694

Appendix Table L. Crop Water Demand with Climate Change (Year 2050s Climate for High Demand Years) Using Surveyed Crops and Irrigation Systems and Good Management

	Climate Model									Crop Irrigation Total		
	Access1 rcp85			CanESM2 rcp85			cnrm-cm5 rcp85					
Year	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
2053	1,019.70	**7,521,953**	738	1,019.70	**8,765,364**	860	1,019.70	**5,534,162**	543	1019.70	**7,273,826**	714
2056	1,019.70	**7,152,714**	701	1,019.70	**5,929,627**	581	1,019.70	**4,427,300**	434	1019.70	**5,836,547**	572
2059	1,019.70	**7,457,352**	731	1,019.70	**8,325,459**	816	1,019.70	**6,788,496**	666	1019.70	**7,523,769**	738

Appendix Table M. Water Demand by Crop with Buildout, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Crop Group	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Apple	10.5	65,455	623	0	0	0	12.5	86,124	687	23.1	**151,579**	658
Berry	1,420.00	4,025,424	283	0	0	0	8.7	37,942	439	1,428.60	**4,063,366**	284
Cherry	1.3	8,388	639	0	0	0	0	0	0	1.3	**8,388**	639
Corn	28.1	214,499	763	0	0	0	48.3	358,460	742	76.4	**572,959**	750
Forage	915.1	7,145,954	781	0	0	0	227.7	1,888,865	829	1,142.90	**9,034,818**	791
Fruit	1.1	9,744	925	0	0	0	0.4	3,179	744	1.5	**12,924**	872
Grape	315	709,503	225	0	0	0	16.1	66,839	416	331.1	**776,341**	234
Nursery	27.7	223,610	806	0	0	0	26.7	205,467	771	54.4	**429,078**	789
Nursery Floriculture	6.7	40,123	601	0	0	0	3.6	20,037	560	10.3	**60,160**	587
Vegetable	881.7	2,824,928	320	0	0	0	130.8	789,107	603	1,012.60	**3,614,036**	357
	3,607.30	**15,267,627**	423	0	**0**	0	474.8	**3,456,021**	728	4,107.00	**18,988,830**	462

Appendix Table N. Crop Water Demand with Buildout, Climate Change (Year 2050s Climate for High Demand Years), and Good Management

	Climate Model									Crop Irrigation Total		
	Access1 rcp85			CanESM2 rcp85			cnrm-cm5 rcp85					
Year	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
2053	4,107.00	**20,976,528**	511	4,107.00	**24,262,311**	591	4,107.00	**14,166,511**	345	4107.00	**19,801,783**	482
2056	4,107.00	**20,454,103**	498	4,107.00	**16,847,693**	410	4,107.00	**11,028,097**	269	4107.00	**16,109,964**	392
2059	4,107.00	**19,629,275**	478	4,107.00	**22,990,722**	560	4,107.00	**16,322,801**	397	4107.00	**19,647,599**	478

Appendix Table O. Water Demand by Irrigation System with Buildout, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Irrigation System	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Drip	2,434.20	6,605,554	271	0	0	0	22.8	115,635	507	2,457.00	**6,721,189**	274
Gun	6.6	45,238	687	0	0	0	0	0	0	6.6	**45,238**	687
Handline	13.2	83,108	629	0	0	0	35.1	289,805	824	48.4	**372,912**	771
Microspray	1.4	9,196	646	0	0	0	0	0	0	1.4	**9,196**	646
Microsprinkler	3.3	22,330	675	0	0	0	2.7	21,591	798	6	**43,921**	730
Overtreedrip	51.2	273,533	534	0	0	0	30.5	149,859	492	81.7	**423,392**	518
Pivot	0	0	0	0	0	0	27.9	196,031	702	27.9	**196,031**	702
PivotLP	150.7	955,194	634	0	0	0	0	0	0	150.7	**955,194**	634
SDI	0.7	3,148	429	0	0	0	0	0	0	0.7	**3,148**	429
Sprinkler	386.9	2,960,054	765	0	0	0	61.6	480,986	781	448.5	**3,441,040**	767
Ssovertree	38.7	284,278	735	0	0	0	30.8	227,787	740	69.4	**512,065**	738
Sssprinkler	3.1	22,167	718	0	0	0	0	0	0	3.1	**22,167**	718
Ssundertree	0.9	5,477	605	0	0	0	3.2	24,460	761	4.1	**29,937**	727
Subirrig	0	0	0	0	0	0	1.3	6,172	465	1.3	**6,172**	465
Travgun	525.7	4,133,944	786	0	0	0	238.7	1,798,535	754	764.4	**5,932,478**	776
Wheelline	7.5	50,024	671	0	0	0	28.4	224,724	792	35.8	**274,748**	767
	3,624.10	**15,453,245**	426	0	**0**	0	482.9	**3,535,585**	732	4,107.00	**18,988,830**	462

Appendix Table P. Water Demand by Soil with Buildout, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Soil Texture	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**	**Irrigated Area (ha)**	**Irrigation Demand (m^3)**	**Avg.Req. (mm)**
Cultured Medium	16.9	185,618	1,100	0	0	0	8.1	79,564	985	24.9	**265,181**	1,063
Loam	43.8	156,518	357	0	0	0	4.5	36,485	807	48.3	**193,002**	400
Loamy Sand	251.2	1,355,010	540	0	0	0	22.8	157,076	690	273.9	**1,512,086**	552
Organic	47.5	202,239	425	0	0	0	11.7	67,368	573	59.3	**269,607**	455
Sand	89.2	185,854	208	0	0	0	1.2	13,483	1,133	90.4	**199,337**	221
Sandy Loam	967.4	5,220,996	540	0	0	0	69	504,985	732	1,036.40	**5,725,981**	552
Sandy Loam (defaulted)	20.5	91,633	446	0	0	0	0.4	4,967	1,372	20.9	**96,600**	462
Silt Loam	1,453.00	4,508,615	310	0	0	0	115.2	877,728	762	1,568.20	**5,386,343**	343
Silty Clay Loam	734.6	3,546,763	483	0	0	0	250.1	1,793,930	717	984.7	**5,340,692**	542
	3,624.10	**15,453,245**	426	0	**0**	0	482.9	**3,535,585**	732	4,107.00	**18,988,830**	462

Appendix Table Q. Water Demand by Subbasin with Buildout, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Subbasin	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Unknown	1,663.80	9,056,409	544	0	0	0	423.4	3,131,843	740	2,087.10	**12,188,252**	584
Ayum Creek	8.3	52,487	636	0	0	0	0.2	1,074	636	8.4	**53,561**	636
Bilston Creek	111.1	551,854	497	0	0	0	17.8	123,999	697	128.9	**675,853**	524
Coloquitz River	316.5	1,751,233	553	0	0	0	27.7	179,820	648	344.3	**1,931,053**	561
Colwood Creek	3.6	10,389	287	0	0	0	0	0	0	3.6	**10,389**	287
Craigflower Creek	1.3	4,707	349	0	0	0	0.2	1,358	819	1.5	**6,065**	400
De Mamiel Creek	75	396,205	528	0	0	0	0	205	1,224	75	**396,409**	528
Fairy Creek	44	72,608	165	0	0	0	0	0	0	44	**72,608**	165
Gillespie Creek	34.7	137,111	395	0	0	0	3.6	24,888	685	38.4	**161,999**	422
Gordon River	97.6	156,271	160	0	0	0	0	0	0	97.6	**156,271**	160
Harris Creek	21.4	76,452	357	0	0	0	0	0	0	21.4	**76,452**	357
Jacob Creek	0	0	0	0	0	0	0.2	454	282	0.2	**454**	282
King Creek	184	789,934	429	0	0	0	0.9	3,955	437	184.9	**793,889**	429
Lens Creek	0.7	969	147	0	0	0	0	0	0	0.7	**969**	147
Renfrew Creek	83.6	162,405	194	0	0	0	0	0	0	83.6	**162,405**	194
San Juan River	868.4	1,748,352	201	0	0	0	0	0	0	868.4	**1,748,352**	201
Sooke River	33.9	146,584	432	0	0	0	1.1	7,079	625	35	**153,663**	439
Tod Creek	74.9	335,485	448	0	0	0	7.8	60,911	777	82.7	**396,396**	479
Veitch Creek	1.4	3,790	279	0	0	0	0	0	0	1.4	**3,790**	279
	3,624.10	**15,453,245**	426	0	**0**	0	482.9	**3,535,585**	732	4,107.00	**18,988,830**	462

Appendix Table R. Water Demand by Water Purveyor with Buildout, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Water Purveyor	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
District Of North Saanich	177	1,233,341	697	0	0	0	0	0	0	177	**1,233,341**	697
The Corporation Of The District Of Central Saanich	370.8	2,138,243	577	0	0	0	0	0	0	370.8	**2,138,243**	577
The Corporation Of The District Of Saanich	140.2	839,240	599	0	0	0	0	0	0	140.2	**839,240**	599
	688	**4,210,824**	612	0	**0**	0	0	**0**	0	688	**4,210,824**	612
Pacheedaht First Nation	21.7	28,831	133	0	0	0	0	0	0	21.7	**28,831**	133
Tsartlip	127.4	539,681	424	0	0	0	0	0	0	127.4	**539,681**	424
Tsawout First Nation	26.2	69,791	267	0	0	0	0	0	0	26.2	**69,791**	267
Tseycum	19.3	170,515	883	0	0	0	0	0	0	19.3	**170,515**	883
T'Sou-Ke First Nation	39.5	137,642	348	0	0	0	0	0	0	39.5	**137,642**	348
	234.1	**946,460**	404	0	**0**	0	0	**0**	0	234.1	**946,460**	404
Private	2,702.10	10,295,961	381	0	0	0	482.9	3,535,585	732	3,185.00	**13,831,546**	434
	2,702.10	**10,295,961**	381	0	**0**	0	482.9	**3,535,585**	732	3,185.00	**13,831,546**	434
	3,624.10	**15,453,245**	426	0	**0**	0	482.9	**3,535,585**	732	4,107.00	**18,988,830**	462

Appendix Table S. Water Demand by Local Government with Buildout, Year 2003 Climate, and Good Management

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Local Government	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)	Irrigated Area (ha)	Irrigation Demand (m^3)	Avg.Req. (mm)
Capital Regional District	1,188.60	2,598,540	219	0	0	0	4.6	29,232	632	1,193.20	**2,627,772**	220
City Of Colwood	0.9	3,370	365	0	0	0	0	0	0	0.9	**3,370**	365
City Of Langford	34.8	134,198	385	0	0	0	4.6	23,114	505	39.4	**157,312**	399
District Of Highlands	0	0	0	0	0	0	0.2	1,358	819	0.2	**1,358**	819
District Of Metchosin	185.6	873,252	471	0	0	0	37.4	275,419	737	222.9	**1,148,670**	515
District Of North Saanich	445.7	2,622,946	588	0	0	0	163.5	1,299,039	794	609.2	**3,921,985**	644
District Of Sooke	203.3	979,409	482	0	0	0	1.4	8,422	606	204.7	**987,831**	483
Pacheedaht First Nation	21.7	28,831	133	0	0	0	0	0	0	21.7	**28,831**	133
The Corporation Of The District Of Central Saanich	774.7	4,356,951	562	0	0	0	213	1,509,018	708	987.7	**5,865,969**	594
The Corporation Of The District Of Oak Bay	9.6	46,005	479	0	0	0	0	0	0	9.6	**46,005**	479
The Corporation Of The District Of Saanich	537.8	2,856,413	531	0	0	0	57.5	389,510	677	595.3	**3,245,923**	545
The Corporation Of The Township Of Esquimalt	7.2	29,474	408	0	0	0	0	0	0	7.2	**29,474**	408
Town Of View Royal	1.8	6,228	350	0	0	0	0.7	473	68	2.5	**6,701**	271
Tsartlip	127.4	539,681	424	0	0	0	0	0	0	127.4	**539,681**	424
Tsawout First Nation	26.2	69,791	267	0	0	0	0	0	0	26.2	**69,791**	267
Tseycum	19.3	170,515	883	0	0	0	0	0	0	19.3	**170,515**	883
T'Sou-Ke First Nation	39.5	137,642	348	0	0	0	0	0	0	39.5	**137,642**	348
	3,624.10	**15,453,245**	426	0	**0**	0	482.9	**3,535,585**	732	4,107.00	**18,988,830**	462