



AECOM



Greater Vernon Water (GVW)

Technical Memorandum No. 5 Independent Agricultural System

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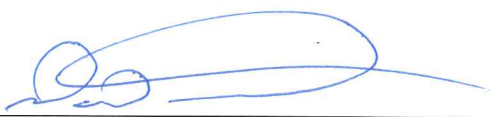

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Technical Memorandum No. 5

Independent Agricultural System

1. Introduction

Agriculture is an important industry in Greater Vernon whose on-going economic viability relies on access to an adequate supply of low-cost water. Currently, Greater Vernon Water (GVW) services domestic and agriculture users with treated water from the Mission Hill and Duteau Creek Water Treatment Plants. Most agricultural practices, however, do not require treated water; particularly irrigation or stock watering. A potential solution of separating the agricultural distribution and supply from the potable system is currently being applied in other communities in the Okanagan. GVW has also implemented a series of separation projects over the last ten years in conjunction with the goal of reducing treatment capacity at the Duteau plant, and thereby reducing capital, operations and maintenance costs for that facility. The extent and cost of system separation projects needs to be effectively planned, providing a cost-effective solution to meeting the utility's needs. The objective is to obtain information and analyze two rationales:

1. Complete system separation, and
2. Partial system separation to varying degrees.

1.1 Tasks Addressed in this Technical Memorandum

Technical Memorandum No. 5 identifies the agricultural areas within GVW and examines such issues as water sourcing, storage and distribution requirements. The objective of this analysis will be to examine the costs and issues in the development of a separate non-potable agricultural water system in the Greater Vernon area. The analysis will provide updated data, context and reference materials consistent with the requirements in the Terms of Reference task numbers 2, 12, 13, 23 and 30. This includes:

- An analysis into current agricultural practice trends in the service area regarding crops and associated irrigation practices.
- A review of all current plans to phase separation of the current GVW combined system into potable and non-potable irrigation systems.
- An assessment of the City of Vernon Reclaimed Water System and its potential impacts on a future separated water system.

Information from this report has also been used in the development of other technical memoranda in this Master Water Plan (MWP) to respond to specific objectives in the overall study including:

- Compiling a data inventory of current reports, mapping, data, and historical information on all systems;
- Reviewing and revising water supply, demand and consumption data for agriculture, and project consumption based on the planning horizon.
- Analyzing operational requirements for seasonal and non-seasonal requirements.
- Confirming strategies for handling fire demands in areas where separate domestic and agricultural irrigation supply systems are proposed.
- Identifying all sources of non-potable supply, including untreated surface waters, ground water, and reclaimed effluent.
- Recommending revisions to the system separation strategies based on conclusions from the water system planning process.
- Examining planning options to develop non-potable water utilities separate from the potable systems.
- Identifying potential ownership and operational responsibilities of the irrigation systems.

- Evaluating all system and balancing storage requirements for the non-potable systems.

1.2 Rationale for Complete System Separation

The concept of system separation of agricultural and domestic systems was introduced in the 2001 GVW Water Utility Master Plan. The logic of this concept dictates that an agricultural water supply, which does not necessarily require treated water, should be delivered completely separate from a potable water system.

The history of the Greater Vernon Water utility has demonstrated that the water supplies to the agricultural and urban community have been and still are intertwined. The early history of the Vernon area is based on agriculture. Raw water has always been routed from the hills and lakes around Vernon through canals and (later) with pipelines. Farm potable use was often based on a more naturally filtered groundwater supply. As the community grew, plans of reliably supplying potable water shifted to cost-effective treatment of the raw water agricultural supply.

Today, potable water supplies must meet regulations that demand high quality drinking water. Currently, to meet these regulations, GVW treats all its surface water to a high quality standard and delivers it to all users in the system. Since agriculture consumes approximately 60 percent of the water supplied annually in the GVW, the costs of treating this water may be un-necessarily high. The capital costs of separating the system are also considered high.

A completely separated system provides some non-quantifiable benefits, including:

- Flexibility of sources,
- Flexibility of governance,
- Separation of costs of operation.

This report examines the status of the agricultural system in the GVW area, the agricultural system needs and requirements, then the actual costs of completely separating the system. This report will also comment on the upgrades required to operate and maintain it in a cost-effective manner.

1.3 Rationale for Partial System Separation

Throughout the planning process, it was considered that varying degrees of system separation of the agricultural system from the domestic (potable) system in GVW may be a more cost effective approach. Is there an optimum level of system separation that minimizes long term operation and capital costs?

Questions were raised about why some areas required more irrigation supply than others:

- In many areas of the community, the rural and urban landscapes are mixed. Water consumption in these areas may be lower than other more intensively irrigated areas.
- Some areas are not intensively farmed, but require stock watering, pasture irrigation or small commercial supply.
- Some lots that are zoned for agricultural have farm status and were previously allocated, but no longer use that allocation.

Technical Memorandum No. 9 – System Separation Options will examine other potentially cost-effective options using the data and cost information developed in this report. The ultimate goal is to implement a strategic plan that, in the long term provides a robust, reliable and cost-effective supply and distribution system for both agricultural and non-agricultural uses.

2. Current Agricultural Practices

2.1 Irrigated Area and Demands

As of 2011, the total area available to be irrigated for agricultural purposes within GVW is 3,452 ha (RDNO, 2012). 2,564 hectares are currently on the District roll paying irrigation rates for water supplied on a per hectare basis. The remaining 888 ha of allocation is considered dormant; do not receive irrigation water; pay a maintenance rate to maintain an allocation; but continue to pay normal domestic rates. The large “dormant” allocations may partly be due to the relatively low cost of maintaining the allocation (\$59.50/ha/quarter) versus the cost of purchasing new allocation at \$6000/ha. This is discussed in some detail in TM1 - Domestic & Agricultural Water Demand Forecast.

If the 3,452 ha were irrigated today, a maximum allocation of 18,986 ML/yr would be required (5.5 ML/ha/yr or 550 mm/yr application per hectare). If only those lots with an agricultural water rate are considered (2564 ha of allocation), the comparison becomes much closer 12,600 ML/yr consumed vs. an active allocation of 14,102 ML/yr.

In 2011, all water actively used by over 90 percent of the agricultural customers was metered. The total metered usage was 8,403 ML or 67% of the total 2011 agricultural consumption estimate of 12,600 ML/yr. Note that 2011 was a relatively wet year.

From TM1 – Domestic & Agricultural Water Demand Forecast, 1, it was concluded that a separate agricultural system will need to have the capacity for a demand of 17,400 ML/yr in the year 2052. This allows for irrigation to allocation, as well as some added contingency for anticipated climate change and some expansion.

The impact of this situation within a separated or partially separated agricultural water system would be:

1. The original irrigation transmission system is capable of supplying irrigation water to at least 3,455 ha (NOWA, 2001).
2. New separated agricultural system components could be designed at a lower capacity to accommodate only the 2,564 ha currently being irrigated. A contingency for growth or expansion should also be incorporated to accommodate the unknown elements of growth and potential increases in demand due to climate change. These elements are discussed in detail in TM No.1. The design flow rates are shown in Table 2-1.

Table 2-1. Demand Forecast
(Source TM1- Domestic & Agricultural Water Demand Forecast)

Year	Annual Demand (ML/yr)				Max. Day Demand Consumption (ML/d)		
	Domestic	Agricultural (typ.)	Agricultural (allotment)	Total	Domestic	Agricultural	Total
2011	9,670	12,600	17,400	27,100	59.4	213	272
2016	9,880		17,400	27,300	60.1	213	273
2021	10,470		17,400	27,900	63.1	213	276
2026	11,060		17,400	28,500	66.0	213	279
2031	11,550		17,400	29,000	68.1	213	281
2041	12,450		17,400	29,900	73.4	213	286
2052	13,360		17,400	30,800	78.5	213	292

2.2 Irrigation and Cropping Practices

The Okanagan Basin Water Board, in partnership with various local, provincial, federal and First Nations stakeholders, has been developing better systems to track natural water flows, establish water-use patterns, and estimate how these will change in the future.

The Okanagan Water Supply and Demand Project is the most advanced water resource assessment ever conducted in Canada, using the latest models and computer technology to estimate Okanagan water availability, taking into account climate change and population growth. The Project includes studies on groundwater, stream-flows, environmental water needs, and water use – balancing water supplies and water demands through a computer accounting model.

Input parameters to the model came from 2003 current trends in cropping practices (Table 2-2) and irrigation system types (Table 2-3) in the Greater Vernon area. A more detailed data summary is provided in Appendix C. These trends have not changed significantly today.

Upon further examination, approximately 45 percent of agricultural demand is dedicated to irrigating forage or corn silage. The next highest user is ranches or small acreages at 36 percent. The remainder of the areas are tree fruits, market gardens and for recreational use. In the reclaimed water supply areas, the forage and tree fruit percentages are slightly higher. Because of the large forage and small acreage irrigation requirements, approximately 80 percent of the land is irrigated using impact type or travelling hose reel sprinklers.

Looking to the future, agricultural economic trends are not likely to change enough to impact water demand significantly. Forage, silage and turf irrigation are typically among the highest consumption crops. There may be a trend in the future to convert some of these lands to orchards or vineyards, which typically consume less water. The irrigation conversion costs to a vineyard or orchard, however, are an added cost to the landowner.

**Table 2-2. Percent of Irrigated Area by Crop Type
(Compiled from information in Appendix D)**

Crop Type	Surface Supplied	Groundwater Supplied	Total
Forage/Silage	37%	7%	44%
Tree Fruit	12%	2%	14%
Market	2%	0%	2%
Small Acreages	35%	1%	36%
Sports Fields	3%	0%	3%

**Table 2-3. Percent of Irrigated Area by Irrigation System Type
(Compiled from information in Appendix D)**

Irrigation System Type	Surface Supplied	Groundwater Supplied	Total
Travelling Hose Reels	12%	3%	15%
Micro	11%	2%	13%
Impact Sprinklers (incl. Pivots)	29%	5%	33%
Landscape Sprinklers	37%	1%	38%
Golf Sprinklers	1%	0%	1%

3. Supply and Distribution Infrastructure

The following section examines the current infrastructure and costs required to both replace and separate the distribution and operational components.

3.1 Methodology

The following section will focus on developing costs of individual project components that form a separated agricultural system, and the capital requirements to complete this work. Later in the process, other factors will be introduced to examine the costs and benefits of constructing each identified capital project.

3.1.1 Assumptions

A completely separate agricultural water system for GVW requires the following key components:

- Safe and reliable water sources.
- Reservoirs.
- Transmission mains.
- Distribution systems.
- Establishment of irrigation rate structure to recover costs for administration, operations, maintenance and long term capital replacement.
- The agriculture supply and distribution will be constructed to a comparable design standard to the potable water system. There may be opportunities during detailed design where cost savings can be realized.

For this analysis, we make the following assumptions:

- All potable water is supplied through one of two water treatment plants, Duteau Creek or Mission Hill water treatment plants. There are no Point of Entry system options.
- Groundwater, where available and feasible, is a viable potable water supply for rural residences. TM2 identified potential supply of groundwater for agricultural irrigation. The feasibility and costs of this option will depend on a variety of system separation factors to be discussed in TM9 – System Separation Options. The cost estimates in this Technical memorandum do not include groundwater supply costs. On a case by case basis, groundwater could be a viable agricultural source to smaller parcels, but the overall supply of agricultural water is too large to rely on groundwater.

- The current water system is capable of supplying current irrigation flows and fire flows.
- Raw Water Definition: All non-treated water from a water supply. This water may be chlorinated for the purposes to maintain optimum chlorine residuals within the pipeline distribution network.
- Upland reservoirs supply water for both potable and non-potable uses.
- Peak Irrigation water demand = 0.79 L/s/ha (5 USgpm/ac); no diurnal peaking factors.
- The City of Vernon reclaimed water for irrigation could be blended into the Agricultural system in the future to provide a more robust water supply. Use of this source is discussed later in this Technical Memorandum. For this analysis, the system remains its own separate entity.
- Pipeline installation is assumed to be standard depth. There are no shallow options examined.

3.2 Background Information

The Regional District of North Okanagan (RDNO) provided a detailed number of past studies, mapping information, metering data, and drought plans to be reviewed as part of this work. In addition, property information, pipe data and details of all structures and utility components were collected from the RDNO mapping database and archive. All this information was correlated with the current GVW water system model information from WaterCad. Figure A-1 in Appendix A are samples of the representations from the data available.

Once updated, the data was then used to compile base information for this analysis.

3.3 System Valuation

For this study, comparisons will be based on unit costs and coarse estimates of values of various components that will be used throughout this MWP. The system will be valued as a cost of complete replacement in 2012. The following unit costs were used in this analysis:

- Pipeline Replacement costs, as in Table 3-1. All pipe construction costs assume paving and road rehabilitation is required.
- Pump stations
 - Base cost - \$ 200,000 plus
 - \$ 6000/hp installed capacity up to 100 hp
 - \$ 3000/hp installed capacity in excess of 100 hp.
- Open seasonal storage reservoirs
 - Duteau Watershed - include dam, spillway and preparations, \$10,000,000 per reservoir.
 - Smaller reservoirs at \$500,000 per reservoir.

Determining an accurate valuation of the water system is difficult, as there are many hidden elements and areas of intrinsic value. For example, costs of a new dam involve both the construction and engineering. There is no land value, nor value of the water license.

- Balancing tanks – Replacement costs are based on \$500,000 per /ML of storage.
- Small structures such as valve stations and water metering stations are valued at \$100,000 per site.
- Service connection
 - Agricultural - \$4,000 (average) per connection, including valves and meters.
 - Domestic - \$3,000 (average) per connection, including corporate and curb stops.
- Contingencies (30%) - include unknown items and factors consistent with this broad cost estimate. Typical types of contingencies at this level include additional studies, unexpected geotechnical

conditions, cost estimate discrepancies, unforeseen costs, etc. As design progresses, the costs are more precise, and contingency percentages typically decrease.

- Engineering and Environmental (15%) generally includes all studies, approvals, design and construction. Note that environmental costs can be higher on large scale projects, such as dams or water treatment plants.

As a cost comparison, the current West Swan Lake System Separation as-constructed program costs were examined. The pipeline costs averaged \$440 per lineal metre of water main including supply and installation, valves, and road restoration for primarily 250 mm diameter water main. The road restoration work included additional costs for secondary highway works. The rate excludes service connections (completed under separate contracts) and engineering. Considering the extra work and contingencies involved, this value compares reasonably with the unit cost given in Table 3-1 (\$350 for 250 mm diameter pipeline, with road restoration).

Table 3-1. Unit Costs for Pipeline Installation (\$/metre)

Diameter	Pipe Supply & Install (1)	Pavement Restoration	Total Incl Pavement	Domestic Mainline Costs	
				Add Hydrants or Standpipes ²	Domestic Pipeline Unit Cost
25	\$70	\$75	\$145		\$145
50	\$80	\$75	\$155		\$155
75	\$90	\$75	\$165		\$165
100	\$120	\$75	\$195	\$35	\$230
150	\$140	\$75	\$215	\$35	\$250
200	\$190	\$75	\$265	\$35	\$300
250	\$240	\$75	\$315	\$35	\$350
300	\$290	\$75	\$365	\$35	\$400
350	\$340	\$90	\$430	\$35	\$465
400	\$390	\$90	\$480	\$35	\$515
450	\$440	\$90	\$530	\$35	\$565
500	\$490	\$90	\$580	\$35	\$615
600	\$590	\$100	\$690	\$50	\$740
750	\$740	\$100	\$840	\$50	\$890
900	\$890	\$100	\$990	\$50	\$1,040
1200	\$1,190	\$110	\$1,300	\$50	\$1,350

Notes:

1. PVC or DI Pipe including valves
2. Assumes one hydrant or standpipe per 300m.
3. Costs do not include engineering or contingencies

4. Current GVW System

The existing water supply system consists of source water supplies, reservoirs, intakes, pipelines, services, balancing reservoirs and storage tanks, pump stations and a variety of valve stations. The information is derived from the GIS information supplied by RDNO and the City of Vernon. Costs of larger structures, such as dams or water treatment plants are handled independently. Again, the goal is relative accuracy for determination of comparative solutions and rate structures.

The utility is broken into the following systems:

- *Mission Hill Treated system (MHT)* - The treated water system that is serviced from the Mission Hill Water Treatment Plant. The plant has a current capacity of 40 ML/d, and has the potential for upgrades to meet a peak of 58 ML/d (if licensing allows). The annual license amount however stays the same, regardless of peak. This system includes virtually all of the serviced areas of the City of Vernon plus portions of Coldstream adjacent to Vernon.
- *Duteau Treated system (DT)* - The treated water system that is serviced from the Duteau Water Treatment Plant (current rated capacity of 151 ML/d). This system includes the majority of the serviced areas of Coldstream, and RDNO areas 'B', 'C', and 'D' and Spallumcheen (Stepping Stones subdivision). Several interconnects exist between the DT and MHT systems, including the recent McMechan Interconnection near McMechan Reservoir.
- *Duteau Raw water system (DR)* - The system that is serviced from the un-treated (other than chlorination) raw water from the Duteau source. This system currently only services agricultural uses in the vicinity of the Duteau WTP including the Von Keyserlingk Pump Station.
- *King Edward Raw system (KER)* - The system that is serviced from the King Edward Reservoir (a small area in Lavington). Currently also includes supply from Ranch Well #2.
- *Goose Lake Raw System (GLR)* - The system that is supplied from the Goose Lake Reservoir (as created by the current West Swan Lake separation program). Currently the Goose Lake Reservoir is supplied from the DT system. Once the Swan Lake separation program is complete, the Goose Lake Reservoir will still be supplied from the DT system but separated by backflow prevention devices. Note the Goose Lake Reservoir receives negligible supply from rainfall / local runoff. When complete, this system will service agricultural uses in West Swan Lake and Bella Vista.
- *City of Vernon Reclaimed Effluent (RR)* - City of Vernon Reclaimed Effluent
 - The City of Vernon Water Reclamation Centre treats approximately 13 ML/d. Following treatment, the water is pumped to MacKay Reservoir. During the irrigation season from mid-April to early October, the water is then drawn out, chlorinated and can be applied to approximately 970 ha of land in the Commonage area of Vernon. Other areas irrigated with reclaimed water include Predator Ridge Golf Resort, Vernon Golf & Country Club, the Rise Golf Course, Vernon Seed Orchard, Kalamalka Forestry Centre and Pacific Regeneration's Vernon Nursery, as well as large areas of agricultural land used for grazing and hay production. Public recreation areas, such as Marshall Fields are also irrigated.
 - Estimates of future water supply from the Water Reclamation Centre are included in the City of Vernon Liquid Water Management Plan; currently under development.

The transmission and distribution infrastructure includes the following components:

- Balancing tanks: Storage is in the form of rectangular concrete reservoirs or circular tanks (Table 4-1). All tanks are for treated water only.
- Booster pump stations: There are 44 booster pump stations in the system (Table 4-2).
- Pipelines
 - Water distribution is by buried pipeline for residential, commercial, industrial, recreational, institutional and agricultural use.
 - The water system currently is divided into numerous pressure zones. Pump stations, pressure reducing valve stations and other flow control devices form part of the distribution system. Components are currently sized for blended agricultural and domestic use.

For the purposes of this analysis, we estimate the value of the present GVW system to be \$619.6M, as detailed in Table 4-3.

Table 4-1. Summary of Storage Tanks within GVW

Location	Top Water Level	Height of Water (m)	Active Storage Volume (m ³)
Cunliffe Road Reservoir (T-206-2)	500.70	5.8	1,006
Grey Road Reservoir (T-210)	503.80	3.3	164
Lavington Reservoir (T-208)	585.08	4.6	2,189
Whisper Ridge (aka Sovereign) Reservoir (T-212)	730.62	3.4	637
Beverly Hills Estates Reservoir (T-118)	517.60	4.6	677
Mount Royce Reservoir (T-120)	745.30	6.0	1,398
Kokanee Reservoir (T-119)	563.42	2.2	288
Upper Mission Hill Reservoir (T-112)	549.80	4.6	1,762
Silver Star Foothills Reservoir (T-115)	666.60	6.0	379
DND Reservoir (T-113)	533.00	4.0	165
McMechan Reservoir (T-114)	483.00	7.0	3,927
Sun Peaks Reservoir (T-116)	766.30	4.6	1,889
OK Hills Boulevard Reservoir	510.49	4.3	338
Balsam Court Reservoir	570.00	4.0	525
Tavistock Reservoir	586.30	5.7	139
Longspoon Reservoir	784.30	4.3	1,254
Turtle Mountain Reservoir	585.00	4.8	625
Middleton Mountain Reservoir	586.53	6.0	1,730
Ravine Dr. Reservoir	729.20	3.7	1,549
Total			20,641
			22 ML

Table 4-2. Summary of Pump Stations within GVW

Pump Station	Facility Number ¹	hp	Number of Pumps	Assumed Value ²
Allenby Way (not in use)	34	45	2	\$300,000
Antwerp Springs Wells	202	135	2	\$905,000
Balsam Court PS	40	10	2	\$260,000
Bella Vista PS	2	250	2	\$1,250,000
Brewer Road	19	15	2	\$290,000
Buchanan Road	14	20	1	\$320,000
Coldstream Ranch Well 1	27	125	1	\$875,000
Coldstream Ranch Well 2	28	250	1	\$1,250,000
Coldstream Creek Rd PS	201	60	1	\$560,000
Warren Rd PS	20	200	3	\$1,100,000
Delcliffe (Hill) PS	224	10	2	\$260,000
Delcliffe (Lake) PS	223	15	2	\$290,000
Goose Lake Road PS	32	25	2	\$350,000
Husband Road PS	33	110	3	\$830,000
Kal Lake Intake PS	101	1200	4	\$4,100,000
Kokanee Rd Booster	108	250	2	\$1,250,000
Lateral 1 PS	24	40	1	\$440,000
Lateral 2 PS	23	7	2	\$242,000
Lateral 3 PS	21	25	2	\$350,000
Longspoon PS	220	30	2	\$380,000
Malim Road	7	5	1	\$230,000
McMechan PS	103	440	3	\$1,820,000
NBX 1	6	600	2	\$2,300,000
NBX 2	5	280	3	\$1,340,000
Allenby	38	150	2	\$950,000
OK Landing PS1	105	80	2	\$680,000
OK Landing PS2	107	250	2	\$1,250,000
Okanagan Hills Blvd PS	39	200	2	\$1,100,000
Palfrey Dr.	13	5	1	\$230,000
PRV 1 - PS	30	150	2	\$950,000
Ravine Dr.	215	30	2	\$380,000
Rugg Rd. PS	4	2.5	2	\$215,000
SBX 1	9	290	3	\$1,370,000
SBX 2	8	80	2	\$680,000
Silver Star Foothills PS	104	100	2	\$800,000
Stepping Stones PS	1	37.5	2	\$425,000
Sunpeaks PS	226	90	4	\$740,000
Swan Lake PS	3	120	2	\$860,000
Tronson Rd PS	221	150	2	\$950,000
Turtle Mountain PS	121	100	4	\$800,000
Upper Commonage PS	296	5	1	\$230,000
Valencia Heights	10	20	2	\$320,000
Von Keyserlingk	22	100	3	\$800,000
Whisper Ridge PS	203	40	2	\$440,000
Total	44 stations	6147	92	\$35,462,000

Notes:

1. From GVW water model and asset information.
2. Value based on \$200k base price and \$6,000/hp up to 100 hp or \$3,000 /hp for stations greater than 100 hp.

Table 4-3 Estimated Value of GVW Water System

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
Pipeline ⁶	25	5,630	\$145	816,278	
	50	24,906	\$155	3,860,464	
	75	7,895	\$165	1,302,593	
	100	94,285	\$230	21,685,486	
	150	226,288	\$250	56,572,083	
	200	114,106	\$300	34,231,851	
	250	39,363	\$350	13,776,991	
	300	49,809	\$400	19,923,648	
	350	17,467	\$465	8,122,025	
	400	15,060	\$515	7,755,854	
	450	9,059	\$565	5,118,335	
	500	8,345	\$615	5,132,003	
	600	9,980	\$740	7,384,830	
	750	16,222	\$890	14,437,233	
	900	7,143	\$1,040	7,428,720	
	1200	4,787	\$1,350	6,462,450	
					214,100,000
<u>Other Infrastructure</u> ¹					
Duteau Reservoirs		3	10,000,000	30,000,000	
Other Reservoirs ²		4	500,000	2,000,000	
Intakes (KLPS, Duteau, Goose, King Ed.)		4	4,000,000	16,000,000	
Tanks (@\$500k/ML)		23.0	500,000	11,500,000	
PRV		100	50,000	5,000,000	
Misc. Valves		20	100,000	2,000,000	
Pump Stations and Wells		43	varies	35,462,000	
Mission Hill WTP ³		1	10,000,000	10,000,000	
Duteau Creek WTP ³		1	30,000,000	30,000,000	
Chlorination Buildings (Goose, King Ed.)		2	500,000	1,000,000	
Water Services (Domestic)		22000	3,000	66,000,000	
Water Services (Agricultural)		1050	4,000	4,200,000	
					213,200,000
Sub-Total					427,300,000
Contingency		30%			128,200,000
Engineering & Environmental		15%			64,100,000
Total Value					\$619,600,000

Notes.

1. Major Infrastructure costs are lump sum, and for comparison purposes for this analysis.
2. Other reservoirs include Goose Lake, King Edward, Swan Lake, etc. Costs to build dykes and intakes.
3. Water treatment plant costs are current only, and do not reflect any additional costs required to apply filtration or other IHA requirements in the future.
4. Costs reflect total replacement costs (2012 \$)
5. CoV Reclamation System (incl. MacKay Reservoir) valued at \$14,065,000. Not included here. Part of City of Vernon Liquid Wastewater Management Plan.
6. Hydrants and standpipes are included in unit rates for pipe supply and installation.

5. Planning the Future Agricultural System

In 2012, nearly all water for agricultural use in GVW was supplied from the Duteau Creek watershed. The exception was recently separated agricultural systems in the King Edward areas. Transmission mainlines are required to supply water to all corners of the District. The agricultural transmission line costs are incorporated in both the system's capital value as well as in the operations and maintenance budget. All agricultural water from Duteau Creek (except newly separated areas in Von Keyserlingk) is currently treated at the Duteau Creek water treatment plant. The plant's capacity is rated at 150 ML/d, and was constructed with expectation that an immediate 80 ML/d treatment reduction would be realized by separating approximately 1,040 ha of agricultural land from the nearby Lavington area. Lavington would continue to be sourced from the Duteau watershed. We explore the Lavington projects later in this analysis.

Beyond Lavington, other opportunities exist to reduce the use of potable water on agricultural lands. To continue to service these areas from the Duteau watershed requires more capital for transmission mains, reservoirs, storage tanks, pressure reducing stations, pump stations and other components needed for safe and sustainable supply. The reliance and size of some of these facilities may be reduced or eliminated if water sources, other than Duteau Creek, can be identified.

Two sources of interest include the B.X. Creek and the City of Vernon (COV) reclaimed water use system:

- The B.X. source is currently licensed for 9,107 ML per year by RDNO, however few opportunities exist to store this water for irrigation as the majority of flows occur during spring freshet. There used to be a small reservoir impounded by Dixon Dam (148 ML) within the B.X. Creek watershed (now removed). The land is now privately owned, having been sold by the City in 2005. The opportunities to use this storage for agricultural purposes will be limited to small parcels.
- The water produced by the COV reclaimed water system has certain water quality concerns that need to be addressed. The water source is currently not approved for all agricultural applications. In the future, possible scenarios include blending with other water sources.
- There is potential to transfer any or all of these licenses to Okanagan Lake in the future.

5.1 Goose Lake

Goose Lake is well situated to provide both balancing and intermediate storage and long-term design flexibility to the agricultural distribution system. Natural inflows into the very small lake watershed are negligible. All water must be provided to the lake from other sources. The lake is currently sourced from Duteau Creek. It was originally the storage for water from B.X. Creek with conveyance via the old Grey Canal (~1910-1970). Goose Lake is an open reservoir, and is therefore currently not part of the potable supply system. Goose Lake is also a logical location for future additional storage and blending of the City's reclaimed water for agricultural use. If required, there is also the potential to increase its capacity by raising its dams, although the adjacent lands are not owned by GVW.

5.2 Other Sources

The Okanagan Lake and groundwater sources identified in Technical Memorandum No. 3 – Source Storage and Supply are considered valid for potable use, and are not considered cost effective sources for agriculture. Use of groundwater for agriculture may be valid on a project basis, but are not part of this analysis. We anticipate costs would be equivalent or higher than the assumptions used in this analysis.

6. Future Agricultural System Capital Works

The following analysis incorporates the planning elements described in the previous section. 22 agricultural zones within the District were identified based on pressure zone, boundary restrictions or other unique features (See Figure A-2). Shape files extracted from the RDNO GIS were used to identify individual pipelines, pump stations, valve stations servicing known agricultural connections.

Cost estimates were then developed for capital works required to completely separate the system and operate independently with an adequate supply. The costs and system requirements are consistent with the Lavington Study (AECOM, 2009) and the West Swan Lake system (KWL, 2012), but updated for consistency with other technical memoranda in this MWP.

6.1 Reclaimed Water System

The 970 hectares of agricultural land for potential use by the City of Vernon Reclaimed Water System is also incorporated into the system. We should note that the land itself is not part of GVW allocation for agriculture, nor is it considered as part of the total water consumption for the utility. This system also ignores the supply or booster requirements (costs) to MacKay Reservoir, as these are accounted for in the COV Liquid Waste Management Plan. The annual operating cost for the Spray Irrigation System is \$1.68M annually. The system can currently irrigate up to 970 hectares with a peak irrigation consumption of 65 ML/d. Current average annual consumption is 13 ML/day. The value of the agricultural water supply component of this system was estimated at \$18.5M (Table 6-1). This value may need to be considered in the future if the reclamation system were somehow amalgamated with the agricultural raw water supply.

Table 6-1.
Summary of Cost of Infrastructure for the City of Vernon Water Reclamation System

Irrigation Zone	Area (ha)	Peak Demand (ML/d)	No. of Services	Cost of Replacement		
				Total	\$/MLD	\$/ha
CoV Reclaimed Water ¹	970	65.3	15	18,546,000	285,000	19,000

1. Current Water Usage Statistics from City of Vernon website based on 13 MLD (average annual

2. Replacement costs are for irrigation infrastructure from the outlet of MacKay Reservoir. All capital costs, including supply to MacKay Reservoir are assumed part of the City's Liquid Waste Management Plan.

6.2 Lavington System Separation Study

In 2009, AECOM performed a system separation study and feasibility design of the Lavington system. The Lavington system contains 1,225 hectares of agricultural land presently irrigated, resulting in a potential 70 ML/d being transferred to a raw water supply. The Lavington study confirmed the requirement of an irrigation transmission mainline. Where necessary, the mainlines were twinned for either domestic or irrigation purposes.

The Lavington system was broken into eight unique zones within the area. The study's long term plan assumed a separate irrigation transmission mainline would be required as part of the project to supply Goose Lake from the Duteau Creek head gates (Harvey Lake).

To date, the following projects have been completed:

- Von Keyserlingk, Stage 1a of the Lavington Project included installation of new 900 mm diameter Transmission Main, new domestic pipelines and reconnections.
 - Peak Demand = 8.2 ML/d (See Table 6-2).
- King Edward - Stage 1B of the Lavington Project includes separation of 117 agricultural connections, and subsequent use of the King Edward Lake water supply for irrigation in this area. Once the Lavington system is further separated, the King Edward system could be connected to the Duteau Creek pipeline, if necessary.
 - Peak Demand = 7.86 ML/d.

6.3 Bella Vista and West Swan Lake

Two system separation projects were identified as priorities since 2005 outside of the Lavington area. These included Bella Vista (completed in 2009) and West Swan Lake (to be completed by 2013). These two major projects were initiated because of potable water supply and quality concerns downstream of Goose Lake (which is an exposed reservoir). Agricultural supply continues to be supplied via Goose Lake (which is currently supplied with potable water from Duteau Creek). The potable supply is now directly connected to the system, and no longer connected to the Goose Lake system for supply or balancing. Peak demands off these systems are:

- Bella Vista = 12.0 ML/d.
- West Swan Lake = 9.2 ML/d

The current overall estimate of the West Swan Lake project is \$8,228,000, including engineering and work to date for 10.1 km of water main, services, and a valve station. The estimate includes completed work and still to be tendered work. The estimate also includes about \$900,000 for services and a \$550,000 valve station (separating Goose Lake system from treated water system).

6.4 Value of a Separated Agricultural System

The replacement value of a completely separated agricultural system is \$137,200,000 (See Table 6-2). For financial analyses related to cost recovery, refer to TM8 – Financial Strategies for Water Rates. We note here that the value of the separated agricultural system separation is not the construction costs required to reach this status. The construction cost analysis is developed in Sections 7 and 8.

6.5 Discussion

6.5.1 Implementing a System Separation Plan

This technical memorandum provides all background information for determining the value of a completely separated irrigation system. Other information obtained as part of this analysis complements other analyses in other technical memoranda within this MWP. TM No.9 - System Separation Options will examine implementation options. The decisions to completely separate the potable and agricultural water supplies

are based on technical, social and economic criteria. The costs for separation of each area will be evaluated against the benefits of reducing operating and capital costs for water treatment works.

Table 6-2. Summary of cost of Infrastructure within each Agricultural Zone.

Area	Available Agricultural Land			Peak Demand ² (ML/d)	Replacement Cost of Agricultural Systems	
	Irrigated in 2011 (Farm Status)	Non-Status	Total		Total (\$) ³	\$ per ML/d
Bella Vista	178.4	52.9	231.4	12.02	7,299,000	607,000
Von Keyserlingk	159.3	0.0	159.3	10.73	3,914,000	365,000
Old Kamloops	78.1	81.4	159.5	5.26	9,055,000	1,721,000
Swan Lake West	57.9	26.8	84.6	3.90	2,406,000	618,000
Springfield	148.8	32.2	181.0	10.02	4,064,000	406,000
Antwerp Springs	115.3	23.7	139.0	7.76	3,160,000	407,000
East Buchanan	188.8	20.6	209.4	12.71	4,676,000	368,000
Vimy	259.8	8.2	267.9	17.49	3,834,000	219,000
King Edward ⁴	242.6	6.1	248.6	16.34	7,136,000	437,000
Binns	133.8	27.5	161.4	9.01	3,196,000	355,000
Coldsteam	239.8	23.3	263.1	16.15	4,658,000	288,000
Middleton Mountain	87.7	42.3	130.0	5.91	3,239,000	548,000
Hillview (East Middleton)	114.2	129.0	243.2	7.69	6,805,000	885,000
South BX PZ 585	79.2	32.5	111.7	5.34	5,854,000	1,097,000
South BX PZ 633	51.5	21.1	72.5	3.47	3,173,000	916,000
Pleasant Valley PZ 535	133.9	50.1	184.0	9.02	6,651,000	738,000
North BX B PZ 585	74.0	48.6	122.6	4.98	4,012,000	805,000
North BX C PZ 610	84.7	37.3	122.0	5.71	3,198,000	560,000
Swan Lake East	48.9	139.7	188.6	3.29	4,979,000	1,512,000
Coldstream West	39.3	0.4	39.7	2.65	941,000	355,000
Stepping Stones	48.4	41.5	89.9	3.26	2,375,000	728,000
Misc. (incl. Uplands)	0.0	43.0	43.0	-		
	2,564	888	3,452	173	\$94,625,000	
Engineering (15%)					\$14,194,000	
Contingencies (30%)					\$28,388,000	
Total Replacement Cost					\$137,207,000	

Notes.

1. Irrigation Zones as defined in Figure A-2.
2. Peak Demands are based on 0.78 l/s/ha of water allocation.
3. Details in Appendix B.
4. West Buchanan connections are incorporated to King Edward works.

6.5.2 Transmission Mainlines

Transmission mainlines are required to transport water throughout the system. The pipelines may include main raw water feeds into water treatment facilities, raw water mainlines for supply to agricultural areas, or potable water transmission lines to domestic distribution systems.

Currently, potable water is able to be transmitted from the Mission Hill and Duteau Creek Water Treatment plants to all areas (agricultural and domestic) in GVW. The exceptions are the newly separated systems in King Edward and Von Keyserlingk areas which are direct connections to a raw water source. Water transmission is incorporated into the system.

Agricultural Transmission Mainlines

The primary source of agricultural raw water is from Duteau Creek. In this analysis, transmission mainlines have been included in the value of the agricultural distributions in the Lavington area.

The AECOM (2009) study assumed that a large diameter pipeline will need to be installed through the Binns area. The need, size and capacity of this pipeline depends on a variety of factors occurring downstream of this area, and acquiring this information is beyond the scope of this MWP.

A second raw water transmission mainline is required if raw water is to be supplied to separated agricultural areas in East Vernon (ie. Swan Lake East, Pleasant Valley or B.X. Creek). This assumption is based on our estimate that the existing transmission line in East Vernon will remain in the potable system since the costs to detach all of the domestic system connections will far outweigh the costs of simply adding a new transmission mainline with few connections.

Potable Transmission Pipelines

This is a complex topic. At this stage of the WMP, it is understood that potable transmission mainlines will be required. The question is where and what size. In the AECOM (2009) study, potable transmission mainlines were required from the Duteau WTP to areas west. In the KWL (2003) study, potable transmission mainlines and intake upgrades were required to and from the Mission Hill WTP. Whichever scenario is selected in TM9 – System Separation Options, only one transmission line is required.

For the remainder of this analysis, we acknowledge that transmission mainlines are required. The length, size and complexity of the work is unknown, and beyond the scope of this technical memorandum. To provide consistent project cost estimates, we will note the following allowances which will form part of the overall capital project estimates in Table 7-1:

- \$5M for a potable transmission mainline from either Duteau WTP, Mission Hill WTP or any other source.
- \$5M for an agricultural transmission mainline through East Vernon toward Swan Lake or Goose Lake. This cost may be offset by finding other sources to some or all of these areas.
- \$1.75 M for an agricultural transmission mainline through Binns into the Hillview area.
- The costs do not include Engineering or Contingency. These are applied later in Table 7-1.

6.5.3 Agricultural Expansion

There was considerable discussion during the planning process about the level of agricultural water consumption anticipated in the future. This is discussed at length in TM1. For this plan, agricultural water demands are estimated to remain constant at 17,400 ML/yr until the year 2052. This figure allows for reductions in consumption through water conservation measures, and some growth within the system. The current supply and distribution system is generally capable of meeting this demand. Larger than anticipated new irrigation acreages may require localized upsizing in some cases.

6.5.4 Reclaimed Water Irrigation Acreage

There were some concerns expressed that the 970 ha (approximate) of agricultural and recreational lands in the Commonage and surrounding areas may, one day, lose their supply of reclaimed water due to possible future changes in how wastewater is managed. This decision to limit supply is beyond the scope of this MWP, and is strictly a decision based on the City's Liquid Waste Management Plan. The City of Vernon has provided information on the current restriction on the use of reclaimed water (See Appendix G).

The current GVW water supply and distribution system currently accommodates 17,400 ML/yr of agricultural demand in addition to domestic requirements. There is no capacity currently to supply to the Commonage and other recreational areas now serviced with reclaimed water. Given the elevation requirements to meet these demands, the costs to supply to these irrigated areas are significant. Alternate sources or storage projects will be required. The sources could include:

- Okanagan Lake,
- Diversion of B.X. Creek in Goose Lake,
- Groundwater,
- Diversion of Greenhow Creek to Goose Lake.

We recommend further studies be performed if these options are being examined.

6.5.5 Reclaimed Water System Supply

Other discussion points also included the potential to incorporate the reclaimed water supply into a separated agricultural system. At this stage, incorporating reclaimed water into the general system does not appear acceptable at this time, and is beyond the scope of this report. On the practical side, the reclaimed water supply connection point would depend on a variety of factors. If MacKay Reservoir continued to be the primary supply point, then an interconnection and pressure regulation would be required. A logical connection point would likely be with the Goose Lake system at Bella Vista Road, which would provide some balancing storage. The distribution system, however, is designed to operate in the opposite direction (pressure regulation, pumping, etc.) There would likely be some additional costs to assure that water can be distributed eastward in the system when necessary.

7. System Separation Construction Costs

At this stage, we know the value of a separate agricultural system. This section determines the estimated project construction capital costs required to implement and achieve full system separation. The project cost estimates were developed so that each project area can be constructed independently of the other. This allows examination of other system separation scenarios to be investigated in TM-9 – System Separation Options.

Tables C1 and C2 provide detailed project estimates for the Lavington study area, which identifies detailed construction costs for the Von Keyserlingk, Springfield, Antwerp Springs, King Edward, Vimy, East Buchanan and Binns sub-areas. As noted earlier, these estimates were developed using the Lavington System Separation Study (AECOM, 2009), and have similar design criteria and assumptions to those in this MWP.

In 2003, following the release of the NOWA MWP, Kerr Wood Leidal was commissioned by GVW to produce a report called “System Separation Program: Hydraulic Modelling and Preliminary Engineering”. The study provided pipeline quantities and detailed discussion on the capacity and costs of implementing a program to completely separate the agricultural components. The study’s base assumptions were different than in this MWP, and the quantities and costs differ significantly when compared to the later Lavington estimates and West Swan Lake project currently under construction.

The 2003 report does provide quantities, however, which are useful in obtaining an estimate of the potable system requirement. An analysis was performed to estimate the costs to separate the remaining project areas using this source of information, and relating it to other work completed here. The details of this analysis are found in Appendix F.

The results are found in Table 7-1. The total cost to completely separate the agricultural system from the domestic potable system is \$80.9M. This estimate includes allowances for transmission mainlines (as discussed in Section 6.5.2. The location and purpose of this transmission main will depend on a variety of factors, including source location, capacity, long term need and growth. These figures and issues are further addressed in TM9 – System Separation Options.

Table 7-1. Summary of System Separation Construction Projects

Suggested Sequence	Project	Farm Status Land Irrigated in 2011 (ha)	Peak Demand (ML/d)	Construction Cost Estimate
1 2 3 4 5 6 7 8	<u>Existing Separation Projects</u>			
	Bella Vista	178.4	12.0	
	West Swan Lake (Completed 2013)	136.0	9.2	
	King Edward - Stage 1B	122.0	8.2	
	Von Keyserlingk - Stage 1A	131.0	8.8	
	<u>Lavington/Coldstream</u>			
	Binns - Stage 1C ¹	133.8	9.0	445,000
	Springfield	148.8	10.0	2,740,000
	Antwerp Springs	115.3	7.8	3,178,000
	East Buchanan	188.8	12.7	2,242,000
	Vimy	259.8	17.5	1,739,000
	King Edward - Remainder	120.6	8.1	874,000
	Von Keyserlingk - Remainder	28.3	1.9	861,000
	Coldstream	239.8	16.1	1,350,000
	<u>East Vernon</u>			
	Middleton Mountain	87.7	5.9	3,670,000
	Hillview (East Middleton)	114.2	7.7	7,467,000
	South BX PZ 585	79.2	5.3	3,504,000
	South BX PZ 633	51.5	3.5	1,400,000
	Pleasant Valley PZ 535	133.9	9.0	3,282,000
	North BX B PZ 585	74.0	5.0	2,655,000
	North BX C PZ 610	84.7	5.7	1,238,000
	<u>Communities</u>			
	Swan Lake East	48.9	3.3	3,454,000
	Coldstream West	39.3	2.6	1,522,000
	Stepping Stones	48.4	3.3	2,390,000
	Misc. (incl. Uplands)	0.0	-	
Sub-Total Area Separation		2,564	173	\$44,011,000
Engineering (15%)				\$6,602,000
Contingencies (30%)				\$13,204,000
Total Project Costs by Area				\$63,817,000
<u>Transmission Mainline Allowances</u> ²				
East Vernon to West Vernon (Potable) ²				5,000,000
Binns (Agricultural or Potable) ³				1,750,000
Lavington (Potable) ³				5,000,000
Sub-Total Transmission Mainlines				\$11,750,000
Engineering (15%)				\$1,763,000
Contingencies (30%)				\$3,525,000
Total Transmission Mainline Allowance				\$17,038,000
Total Estimated Construction Costs				\$80,855,000

Notes:

1. Binns costs minus Transmission Line cost.
2. Transmission Mainlines are required in East Vernon (through Hillview into Pleasant Valley). The extent, capacity or type of mainline is not known, and will depend on separation options examined in TM 9 - System Separation Options. These costs can be offset by establishing other sources (ie. groundwater, diversion or other lake).
3. Costs extracted from Lavington study (AECOM, 2009). Dependent on source selection in TM9.

8. Options for Sequencing of Projects

The information developed in this technical memorandum is primarily for determining the cost of a completely separated agricultural system. The information is reported in such a way that other system separation options can be reviewed in TM9 – System Separation Options. In this section, we examine specific sub-project areas identified earlier in this report, and recommend a sequence of implementing these sub-projects. For this analysis, we examine the project areas identified in Table 6-2, and evaluate the sequence based on a series of factors in sequence:

1. Sub-projects currently constructed or under construction,
2. Sub-projects that separate higher intensity and large agricultural operations,
3. Areas that are dependent on other areas being supplied first,
4. Areas that potentially can be supplied by alternate sources (ie. Groundwater or unused license),

There are areas within the system where the costs or viability of system separation is questionable, either due to higher urban influences in long term development combined with lower agricultural requirements. A cost/benefit analysis may be beneficial in working out these viability issues. At this stage of the analysis, there is not enough known about the water sources to conduct such an analysis. Once this WMP is finalized, a cost-benefit analysis and other tools, such as detailed information collected by GVW using databases like OKIM (Okanagan Irrigation Management System) or meter data, will assist in this decision making process. At this stage, the suggested sequences here are not attempt to determine whether a project should be implemented or not.

8.1 Current System Separation Projects

Areas where system separation has been completed include Bella Vista, and portions of the Von Keyserlingk and King Edward areas (See Figure A-2). The completion of the latter two projects has resulted in a 17 ML/d reduction in the peak capacity of Duteau WTP.

The West Swan Lake system separation project is currently under construction and due to be completed in 2013. West Swan Lake and Bella Vista areas were constructed to improve chronic potable supply concerns. The separated distribution system allows water to be stored in Goose Lake in the off-peak season and reintroduced as an agricultural raw water supply in the summer peak irrigation demand season. This alleviates upstream treatment and transmission capacity requirements at peak demands. A raw water supply source (Peak demand 21.2 ML/d) for agriculture has not been confirmed to date in these areas. For now, these areas continue to be supplied from the treated Duteau Source. These projects are removed from this evaluation.

9. Conclusions

The purpose of the technical memorandum was to provide base cost information on the agricultural system for further planning purposes in the 2012 Master Water Plan process. From this analysis, the following is concluded:

- GVW system can be separated into agricultural and domestic water supplies.
- Additional water sources other than Duteau Creek can be incorporated into the agricultural system. The decision on which sources to examine further will be based upon further developments within this MWP. The extent of availability of these sources will be determined by the extent of separation.
- The system is capable of incorporating the reclaimed wastewater as a supply into a separated agricultural system for irrigation purposes. Operational costs to deliver water for irrigation purposes using reclaimed water are significantly higher than those in the GVW Agricultural System.
- The present day value of a separated agricultural water system is valued at \$137.2M. This does not include any major source work (dam or structure upgrades) in the Duteau Creek Watershed.
- Information developed in this Technical Memorandum will form the basis of the decision making planning efforts in other reports within this MWP.

10. Recommendations

The following tasks are recommended for inclusion in the 2012 MWP:

- The City of Vernon, GVW agricultural community and the provincial government continue to examine options for incorporating water from the COV wastewater reclamation program into a separated agricultural supply. If this supply source is ever approved for inclusion into the separated agricultural system, the sequencing and planning of separation projects identified in this analysis will need revision.
- A more detailed study be undertaken to examine more precisely the potential water savings in areas where small ranches and urban infringement are more prevalent.
- Reviewing the implementation schedules and priorities are recommended every 5 years as part of a MWP capital works update or requirements of provincial legislation.

11. References

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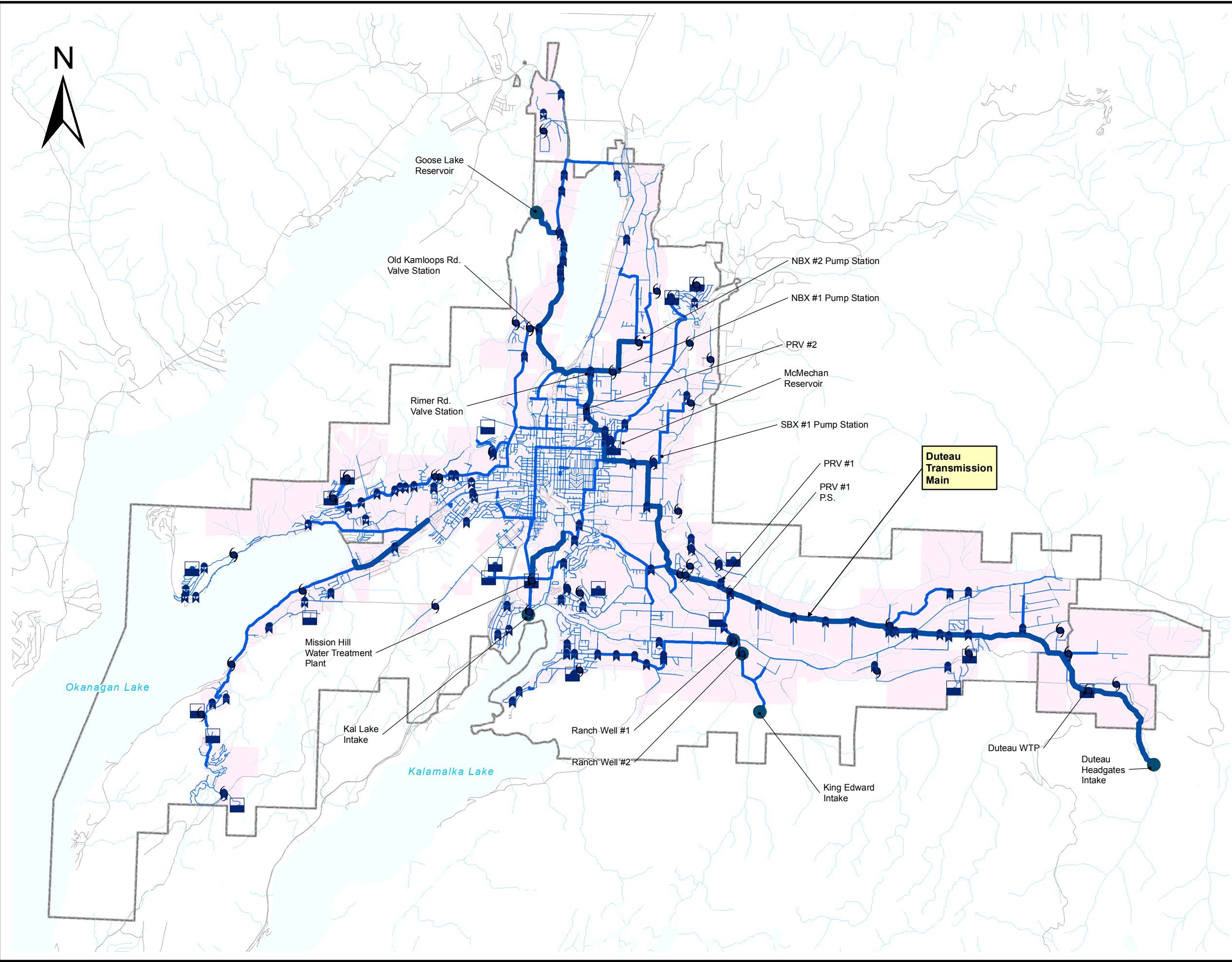
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Appendix A. Figures

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Author: J.Lau



**Greater Vernon Water
2012 Master Water Plan**

Legend

- Jurisdiction Boundary
- Pump Station
- Balancing Reservoir
- Control Valve Station (PRV)
- Source

Water System (mm Ø)

- < 300
- 300 - 600
- > 600



AECOM

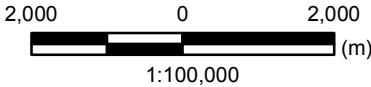
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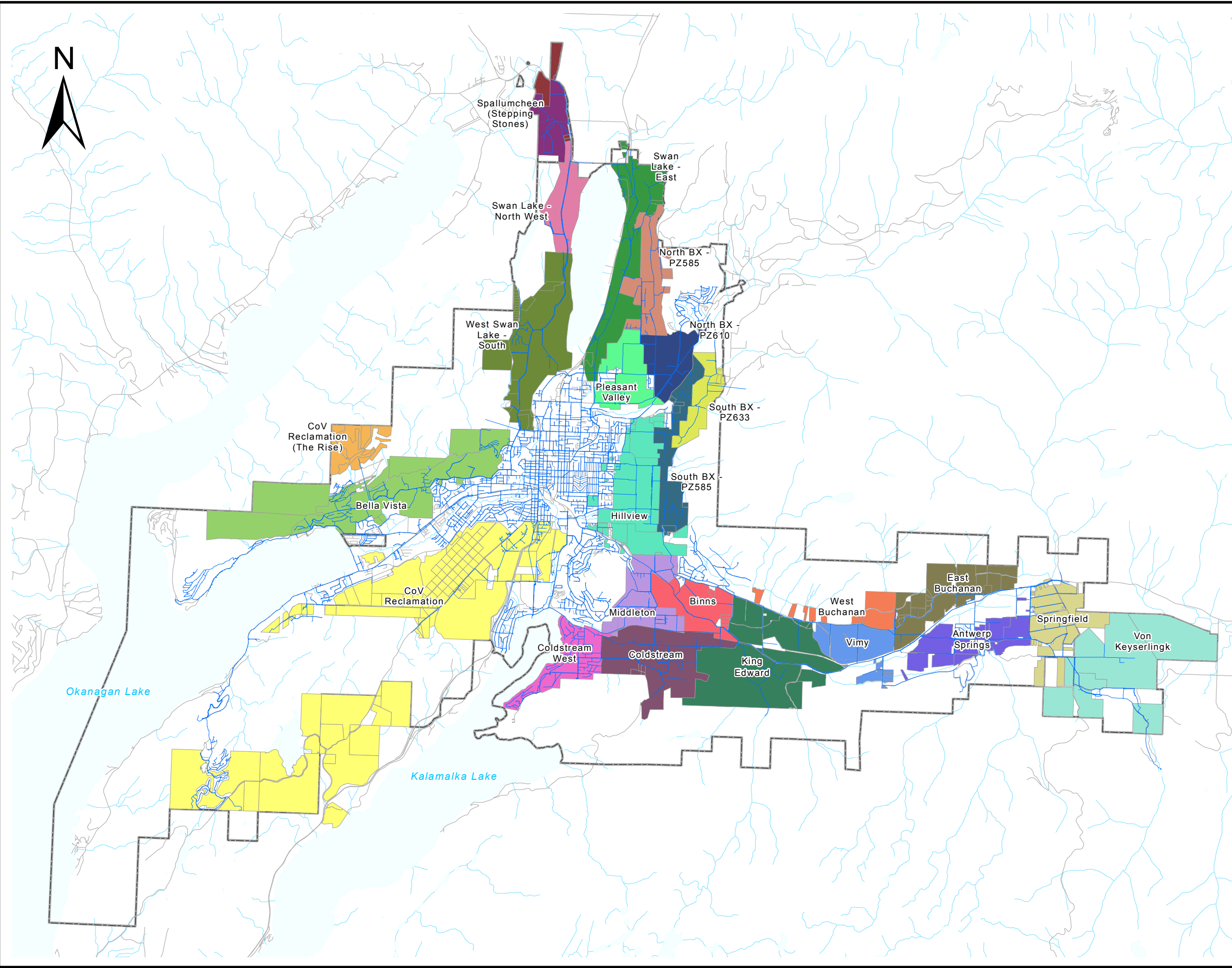
Project No.
811-015

Date
February 2013

**Current System
Configuration**



Figure A-1

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Author: J.Lau



Greater Vernon Water 2012 Master Water Plan

Legend

-  Jurisdiction Boundary
-  Water System



AECOM

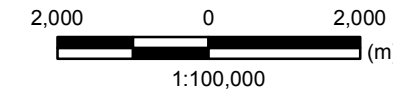
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Project No.
811-015

Date
February 2013

Agricultural System Separation Projects

Figure A-2

Appendix B. Valuation of Agricultural Infrastructure in Each Project Area

Agriculture Infrastructure

Bella Vista

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	519	\$155	80,459	
	75	369	\$165	60,951	
	100	4,631	\$195	903,025	
	150	6,625	\$215	1,424,478	
	200	1,171	\$265	310,275	
	250	795	\$315	250,328	
	300	706	\$365	257,657	
	350	1,622	\$430	697,376	
	400	1,528	\$480	733,602	
	450	2,778	\$530	1,472,597	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	
					6,190,747
<u>Other Infrastructure</u>					
PRV49				100,000	
PRV66				100,000	
PRV59				100,000	
PRV Skyview				100,000	
PRV51				100,000	
PRV52				100,000	
PRV53				100,000	
PRV57				100,000	
PRV60				100,000	
Services		52	\$ 4,000	208,000	
New Works (from Table C2)				-	1,108,000
Sub-Total					7,299,000
Contingency		30%			2,190,000
Engineering & Environmental		15%			1,095,000
Total Value					\$10,584,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

East Buchanan

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	216	\$155	33,480	
	75	0	\$165	-	
	100	1190.6	\$195	232,167	
	150	2318	\$215	498,370	
	200	1161	\$265	307,665	
	250	254	\$315	80,010	
	300	1467	\$365	535,455	
	350	751.5	\$430	323,145	
	400	184.1	\$480	88,368	
	500	0	\$580	-	
	600	0	\$690	-	
	750	0	\$840	-	
	900	0	\$990	-	2,098,660
<u>Other Infrastructure</u>					
PRV#71				100,000	
PRV#4				100,000	
Pump Station 20 (Coldstream)				1,100,000	
PRV#6				100,000	
PRV#7				100,000	
PRV#8				100,000	
Services		26	\$ 4,000	104,000	
New Works (from Table C1)				873,000	2,577,000
Sub-Total					4,676,000
Contingency		30%			1,403,000
Engineering & Environmental		15%			702,000
Total Value					6,781,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Vimy

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	323	\$155	50,065	
	75	444.5	\$165	73,343	
	100	236.5	\$195	46,118	
	150	1069	\$215	229,835	
	200	589	\$265	156,085	
	250	250	\$315	78,750	
	300	0	\$365	-	
	350	0	\$430	-	
	400	0	\$480	-	
	500	0	\$580	-	
	600	0	\$690	-	
	750	1406	\$840	1,181,040	
	900	724.5	\$990	717,255	2,532,490
<u>Other Infrastructure</u>					
PRV #9				100,000	
PRV#10				100,000	
PRV#70				100,000	
Services		37	\$ 4,000	148,000	
New Works (from Table C1)				853,000	1,301,000
Sub-Total					3,834,000
Contingency		30%			1,151,000
Engineering & Environmental		15%			576,000
Total Value					5,561,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Antwerp Springs

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	294	\$155	45,570	
	75	236	\$165	38,940	
	100	915.5	\$195	178,523	
	150	813	\$215	174,795	
	200	0	\$265	-	
	250	263.5	\$315	83,003	
	300	0	\$365	-	
	350	0	\$430	-	
	400	0	\$480	-	
	500	0	\$580	-	
	600	0	\$690	-	
	750	0	\$840	-	
	900	0	\$990	-	
					520,830
<u>Other Infrastructure</u>					
PRV#5				100,000	
PS (To be abandoned)					
Services		42	\$ 4,000	168,000	
New Works (from Table C1)				2,371,000	2,639,000
Sub-Total					3,160,000
Contingency		30%			948,000
Engineering & Environmental		15%			474,000
Total Value					4,582,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Springfield

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Pipeline</u>	50	654	\$155	101,370	
	75	92.5	\$165	15,263	
	100	2956	\$195	576,420	
	150	3581.5	\$215	770,023	
	200	265	\$265	70,225	
	250	187	\$315	58,905	
	300	877.5	\$365	320,288	
	350	183.5	\$430	78,905	
	400	778.5	\$480	373,680	
	500	0	\$580	-	
	600	0	\$690	-	
	750	0	\$840	-	
	900	0	\$990	-	
					2,365,078
<u>Other Infrastructure</u>					
PRV#3				100,000	
Meter Chamber				100,000	
PS#21 (to be abandoned)					
Services		68	\$ 4,000	272,000	
New Works (from Table C1)				1,226,000	
Sub-Total					4,064,000
Contingency		30%			1,220,000
Engineering & Environmental		15%			610,000
Total Value					5,894,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

VonKeyserlingk

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	0	\$155	-	
	75	0	\$165	-	
	100	523.5	\$195	102,083	
	150	1428.5	\$215	307,128	
	200	541	\$265	143,365	
	250	446.5	\$315	140,648	
	300	696.5	\$365	254,223	
	350	0	\$430	-	
	400	0	\$480	-	
	500	0	\$580	-	
	600	0	\$690	-	
	750	0	\$840	-	
	900	0	\$990	-	
	1200	511	\$1,300	664,300	1,611,745
<u>Other Infrastructure</u>					
PS#22 VonK				800,000	
PS#23 (To be decommissioned)					
PS#24 (To be decommissioned)					
Services		10	\$ 4,000	40,000	
New Works (from Table C1)				1,462,000	2,302,000
Sub-Total					3,914,000
Contingency		30%			1,175,000
Engineering & Environmental		15%			588,000
Total Value					5,677,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

King Edward

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	0	\$155	-	
	75	0	\$165	-	
	100	417.5	\$195	81,413	
	150	1910	\$215	410,650	
	200	1379.5	\$265	365,568	
	250	666.5	\$315	209,948	
	300	485.5	\$365	177,208	
	350	0	\$430	-	
	400	0	\$480	-	
	500	2491.2	\$580	1,444,896	
	600	0	\$690	-	
	750	2337.5	\$840	1,963,500	
	900	0	\$990	-	
	1200	0	\$1,300	-	4,653,181
<u>Other Infrastructure</u>					
PRV 11 (To be abandoned)					
PRV 12 (To be abandoned)					
PRV 1				100,000	
Well #1 PS 27				1,250,000	
Well #2 PS 28				875,000	
King Ed Intake				100,000	
Services		20	\$ 4,000	80,000	
New Works (from Table C1)				77,000	2,482,000
Sub-Total					7,136,000
Contingency		30%			2,141,000
Engineering & Environmental		15%			1,071,000
Total Value					10,348,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Binns

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	0	\$155	-	
	75	0	\$165	-	
	100		\$195	-	
	150		\$215	-	
	200	295.5	\$265	78,308	
	250	308.5	\$315	97,178	
	300	0	\$365	-	
	350	0	\$430	-	
	400	0	\$480	-	
	500	0	\$580	-	
	600	0	\$690	-	
	750	1907	\$840	1,601,880	
	900	0	\$990	-	
					1,777,365
<u>Other Infrastructure</u>					
Services		96	\$ 4,000	384,000	
New Works (from Table C1)				1,034,000	1,418,000
Sub-Total					3,196,000
Contingency		30%			959,000
Engineering & Environmental		15%			480,000
Total Value					4,635,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Middleton Mountain

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	-	\$155	-	
	75	484	\$165	79,877	
	100	2,300	\$195	448,488	
	150	3,925	\$215	843,905	
	200	235	\$265	62,332	
	250	213	\$315	67,161	
	300	1,690	\$365	616,942	
	350	1,104	\$430	474,704	
	400	-	\$480	-	
	450	554	\$530	293,428	
	600	-	\$690	-	
	750	-	\$840	-	
	900		\$990	-	
				2,886,836	
<u>Other Infrastructure</u>					
PRV 24		63	4000	100,000	
Services				252,000	
New Works				-	
Sub-Total					3,239,000
Contingency		30%			972,000
Engineering & Environmental		15%			486,000
Total Value					4,697,000

Sources:

Pipeline & Services: RDNO GIS and AECOM (2009) - Lavington Study

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

West Buchanan

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	0	\$155	-	
	75	0	\$165	-	
	100	19	\$195	3,705	
	150	268	\$215	57,620	
	200	0	\$265	-	
	250	0	\$315	-	
	300	0	\$365	-	
	350	0	\$430	-	
	400	0	\$480	-	
	500	0	\$580	-	
	600	0	\$690	-	
	750	0	\$840	-	
	900	0	\$990	-	61,325
<u>Other Infrastructure</u>					
Services		5	\$ 4,000	20,000	
New Works (from Table C1)				-	20,000
Sub-Total					82,000
Contingency		30%			25,000
Engineering & Environmental		15%			13,000
Total Value					120,000

Agriculture Infrastructure

Old Kamloops (Part of 2012/2013 Swan Lake West)

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	1,655	\$155	256,500	
	75	424	\$165	69,880	
	100	2,122	\$195	413,699	
	150	1,910	\$215	410,681	
	200	11	\$265	2,967	
	250	-	\$315	-	
	300	-	\$365	-	
	350	-	\$430	-	
	400	-	\$480	-	
	450	331	\$530	175,225	
	500	2,573	\$580	1,492,565	
	600	2,351	\$690	1,622,281.98	
	750	2,356	\$840	1,979,286	
	900	-	\$990	-	6,423,084
<u>Other Infrastructure</u>					
PRV42				100,000	
PRV45				100,000	
PRV46				100,000	
PS 2 Bella Vista				1,250,000	
PS 32 Goose Lake				350,000	
PRV47				100,000	
PRV48				100,000	
Services		60	\$ 4,000	240,000	
New Works (from Table C2)				291,000	2,631,000
Sub-Total					9,055,000
Contingency		30%			2,717,000
Engineering & Environmental		15%			1,359,000
Total Value					13,131,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Swan Lake North West (Part of 2012/2013 Swan Lake West System Separation Project)

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	-	\$155	-	
	75	-	\$165	-	
	100	-	\$195	-	
	150	6	\$215	1,312	
	200	-	\$265	-	
	250	-	\$315	-	
	300	1,399	\$365	510,570	
	350	602	\$430	258,743	
	400	-	\$480	-	
	450	-	\$530	-	
	500	-	\$580	-	
	600	1,651	\$690	1,139,083	
	750	-	\$840	-	
	900	-	\$990	-	1,909,707
<u>Other Infrastructure</u>					
PRV44				100,000	
PRV41				100,000	
PRV42				100,000	
Services		49	4000	196,000	
New Works (from Table C2)				-	496,000
Sub-Total					2,406,000
Contingency		30%			722,000
Engineering & Environmental		15%			361,000
Total Value					3,489,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Stepping Stones

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	-	\$155	-	
	75	401	\$165	66,165	
	100	137	\$195	26,715	
	150	4,922	\$215	1,058,230	
	200	410	\$265	108,650	
	250	1,009	\$315	317,835	
	300	-	\$365	-	
	350	-	\$430	-	
	400	-	\$480	-	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	1,577,595
<u>Other Infrastructure</u>					
PRV40				100,000	
PS 1 Stepping Stones				425,000	
Services		68	\$ 4,000	272,000	
New Works (from Table C2)				-	797,000
Sub-Total					2,375,000
Contingency		30%			713,000
Engineering & Environmental		15%			357,000
Total Value					3,445,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Swan Lake East

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	348	\$155	53,989	
	75	30	\$165	4,964	
	100	1,186	\$195	231,350	
	150	3,616	\$215	777,390	
	200	4,125	\$265	1,093,242	
	250	2,677	\$315	843,405	
	300	1,956	\$365	714,044	
	350	-	\$430	-	
	400	-	\$480	-	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	
					3,718,384
<u>Other Infrastructure</u>					
PRV38				100,000	
PRV39				100,000	
PRV 74				100,000	
Services		76	\$ 4,000	304,000	
New Works (from Table C2)				655,800	1,259,800
Sub-Total					4,979,000
Contingency		30%			1,494,000
Engineering & Environmental		15%			747,000
Total Value					7,220,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Coldstream

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	942	\$155	146,010	
	75	765	\$165	126,207	
	100	2,267	\$195	442,047	
	150	2,960	\$215	636,469	
	200	416	\$265	110,221	
	250	3	\$315	982	
	300	409	\$365	149,204	
	350	1,216	\$430	522,856.97	
	400	2,876	\$480	1,380,645.41	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	
					3,514,641
<u>Other Infrastructure</u>					
PRV#14				100,000	
PRV#15				100,000	
PRV#16				100,000	
PRV#17				100,000	
PRV#18				100,000	
PRV#19				100,000	
PRV#20				100,000	
PRV#21				100,000	
Services		72	\$ 4,000	288,000	
New Works (from Table C2)				55,300	
					1,143,300
Sub-Total					4,658,000
Contingency		30%			1,398,000
Engineering & Environmental		15%			699,000
Total Value					\$6,755,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Coldstream West

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50		\$155	-	
	75		\$165	-	
	100	646	\$195	125,970	
	150	171	\$215	36,765	
	200	862	\$265	228,430	
	250	605	\$315	190,575	
	300		\$365	-	
	350		\$430	-	
	400		\$480	-	
	450		\$530	-	
	500		\$580	-	
	600		\$690	-	
	750		\$840	-	
	900		\$990	-	
					581,740
<u>Other Infrastructure</u>					
PRV#22				100,000	
Services		9	\$ 4,000	36,000	
New Works (from Table C2)				222,400	358,400
Sub-Total					941,000
Contingency		30%			283,000
Engineering & Environmental		15%			142,000
Total Value					\$1,366,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

Pleasant Valley - Pressure Zone 535

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	317	\$155	49,135	
	75	-	\$165	-	
	100	1,666	\$195	324,785	
	150	5,024	\$215	1,080,071	
	200	1,779	\$265	471,435	
	250	794	\$315	250,031	
	300	280	\$365	102,306	
	350	23	\$430	10,049	
	400	496	\$480	238,084	
	450	22	\$530	11,610	
	500	-	\$580	-	
	600	1,415	\$690	976,343	
	750	83	\$840	69,463	
	900	-	\$990	-	3,583,312
<u>Other Infrastructure</u>					
PS6 North BX 1				2,300,000	
Services		70	\$ 4,000	280,000	
New Works (from Table C2)				486,800	3,066,800
Sub-Total					6,651,000
Contingency		30%			1,996,000
Engineering & Environmental		15%			998,000
Total Value					\$9,645,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

North BX - Pressure Zone 585

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	-	\$155	-	
	75	-	\$165	-	
	100	1,156	\$195	225,485	
	150	1,214	\$215	260,984	
	200	867	\$265	229,750	
	250	986	\$315	310,461	
	300	616	\$365	224,685	
	350	-	\$430	-	
	400	1,525	\$480	732,082	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	1,983,447
<u>Other Infrastructure</u>					
PS5 BX2				1,340,000	
Services		62	4000	248,000	
New Works (from Table C2)				439,700	2,027,700
Sub-Total					4,012,000
Contingency		30%			1,204,000
Engineering & Environmental		15%			602,000
Total Value					\$5,818,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

North BX - Pressure Zone 610

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	332	\$155	51,460	
	75	224	\$165	36,960	
	100	3,749	\$195	731,055	
	150	2,640	\$215	567,600	
	200	1,685	\$265	446,525	
	250	1,223	\$315	385,245	
	300	1,403	\$365	512,095	
	350	-	\$430	-	
	400	-	\$480	-	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	
					2,730,940
<u>Other Infrastructure</u>					
PS 4 Rugg Road				215,000	
Services		63	\$ 4,000	252,000	
New Works (from Table C2)				-	467,000
Sub-Total					3,198,000
Contingency		30%			960,000
Engineering & Environmental		15%			480,000
Total Value					\$4,638,000

Agriculture Infrastructure

Hillview (East Middleton)

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	869	\$155	134,731	
	75	296	\$165	48,906	
	100	1,173	\$195	228,794	
	150	4,318	\$215	928,450	
	200	1,270	\$265	336,650	
	250	424	\$315	133,645	
	300	-	\$365	-	
	350	-	\$430	-	
	400	155	\$480	74,400	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	2,284	\$840	1,918,560	
	900	-	\$990	-	
					3,804,136
<u>Other Infrastructure</u>					
PS9 South BK				1,370,000	
PR27				100,000	
PRV28				100,000	
Services		96	\$ 4,000	384,000	
New Works (from Table C2)				1,046,000	3,000,000
Sub-Total					6,805,000
Contingency		30%			2,042,000
Engineering & Environmental		15%			1,021,000
Total Value					\$9,868,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

South BX 585 - Pressure Zone 585

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	298	\$155	46,263	
	75	-	\$165	-	
	100	2,571	\$195	501,326	
	150	4,503	\$215	968,102	
	200	2,711	\$265	718,417	
	250	557	\$315	175,408	
	300	1,511	\$365	551,379	
	350	836	\$430	359,530	
	400	161	\$480	77,307	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	889	\$840	746,731	
	900	-	\$990	-	
					4,144,464
<u>Other Infrastructure</u>					
Ps 10 Valencia Heights				320,000	
PSV36				100,000	
PSuSV North BX				100,000	
PSuSV South BX				100,000	
Services		59	\$ 4,000	236,000	
New Works (from Table C2)				853,300	1,709,300
Sub-Total					5,854,000
Contingency		30%			1,757,000
Engineering & Environmental		15%			879,000
Total Value					\$8,490,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Agriculture Infrastructure

South BX - Pressure Zone 633

Item	Diameter (mm)	Quantity	Unit Cost	Extension	Totals
<u>Existing Pipeline</u>	50	392	\$155	60,791	
	75	394	\$165	64,938	
	100	2,318	\$195	452,037	
	150	1,735	\$215	373,123	
	200	648	\$265	171,843	
	250	-	\$315	-	
	300	-	\$365	-	
	350	-	\$430	-	
	400	-	\$480	-	
	450	-	\$530	-	
	500	-	\$580	-	
	600	-	\$690	-	
	750	-	\$840	-	
	900	-	\$990	-	1,122,731
<u>Other Infrastructure</u>					
PS South BX 2				680,000	
PS Dixon Dam Road				1,100,000	
Services		38	\$ 4,000	152,000	
New Works (from Table C2)				117,800	2,049,800
Sub-Total					3,173,000
Contingency		30%			952,000
Engineering & Environmental		15%			476,000
Total Value					\$4,601,000

Sources:

Pipeline & Services: RDNO GIS

Infrastructure Numbering: RDNO Water Model - KWL (2012)

Appendix C. Work Required for Agricultural System Separation

Table C.1.

Proposed New Works Required for System Separation
Water Master Plan 2012 - Greater Vernon Water Utility
2012 Costs derived from AECOM(2009) - Lavington System Separation Study

	Unit	Unit Cost	Von Keyserlingk				Springfield				Antwerp Springs				East Buchanan			
			Agricultural Only		Domestic Only		Agricultural Only		Domestic Only		Agricultural Only		Domestic Only		Agricultural Only		Domestic Only	
			Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext
General ²																		
Performance Bonds	LS	1%	1	14,300	1	5,600	1	12,000	1	14,800	1	23,200	1	7,900	1	8,600	1	13,400
Insurance	LS	0.5%	1	7,200	1	2,800	1	6,000	1	7,400	1	11,600	1	4,000	1	4,300	1	6,700
Survey and Layout	LS	0.5%	1	7,200	1	2,800	1	6,000	1	7,400	1	11,600	1	4,000	1	4,300	1	6,700
Water Works																		
PVC Pipe - 50 mm	m	\$85		-	400	34,000		-		-		-		-		-		-
PVC Pipe - 100 mm	m	\$140		-		-		-	370	51,800		-		-		-	2,145	300,300
PVC Pipe - 150 mm	m	\$160		-	2,025	324,000		-	4,675	748,000		-	400	64,000		-	2,260	361,600
PVC Pipe - 200 mm	m	\$180		-		-		-		-		-	700	126,000		-		-
PVC Pipe - 250 mm	m	\$200		-		-		-		-		-		-		-		-
PVC Pipe - 300 mm	m	\$260		-		-		-		-		-		-		-		-
PVC Pipe - 400 mm	m	\$300		-		-		-		-		-		-		-		-
Ductile Pipe - 500 mm	m	\$550		-		-		-		-		-		-	750	412,500		-
Ductile Pipe - 600 mm	m	\$600		-		-		-		-	1,770	1,062,000		-		-		-
Ductile Pipe - 750 mm	m	\$650		-		-	1,240	806,000		-	1,240	806,000		-		-		-
Ductile Pipe - 900 mm	m	\$900		-		-		-		-		-		-		-		-
PVC Pipe - 900 mm	m	\$550	1,400	770,000		-		-		-		-		-		-		-
Services	ea	\$4,000		-	8	32,000		-	66	264,000		-	10	40,000		-	35	140,000
Gates Valves - 50 mm	ea	\$400		-	2	800		-		-		-		-		-		-
Gates Valves - 100 mm	ea	\$400		-		-		-	1	400		-		-		-	7	2,800
Gates Valves - 150 mm	ea	\$500		-	7	3,500		-	20	10,000		-		-		-	8	4,000
Gates Valves - 200-400 mm	ea	\$2,000		-		-		-		-		-		-		-		-
Connections - 100 pipe	ea	\$3,000		-		-		-	1	3,000		-		-		-	1	3,000
Connections - 150 pipe	ea	\$3,500		-	5	17,500		-	6	21,000		-		-		-	2	7,000
Connections - 200 pipe	ea	\$10,000		-		-		-		-		-		-		-		-
Connections - Large Pipe	ea	\$15,000	3	45,000		-	1	15,000		-	5	75,000		-	3	45,000		-
Modifications				-		-		-		-		-		-		-		-
Modifications Duteau Creek	LS	\$25,000		-	1	25,000		-		-		-		-		-		-
Modifications VonKeyserlink BS	LS	\$520,000	1	520,000		-		-		-		-		-		-		-
Decommission Lateral 1 Booster Station	LS	\$10,000		-	1	10,000		-		-		-		-		-		-
Decommission Lateral 2 Booster Station	LS	\$10,000		-	1	10,000		-		-		-		-		-		-
Abandon old Station	LS	\$5,000		-		-		-	1	5,000		-	1	5,000		-		-
Highway 6 and CN Rail Crossing	LS	\$175,000		-		-		-		-		-	1	175,000		-		-
Add PRV Station	LS	\$125,000		-		-		-		-		-		-		-	1	125,000
Domestic PRV Station	LS	\$50,000		-		-		-		-		-		-		-		-
Miscellaneous Work	LS			-		-		-		-		-		-		-		-
Road Work				-		-		-		-		-		-		-		-
Import Backfill Allowance	m ³	\$30	750	22,500	750	22,500	750	22,500	750	22,500	750	22,500	750	22,500	750	22,500	750	22,500
Asphalt Milling & Removal (100 mm depth)	m ³	\$15	200	3,000	200	3,000	1,000	15,000	1,000	15,000	1,000	15,000	1,000	15,000	1,050	15,800	1,050	15,800
Sub-Base, 300 mm depth	m ²	\$14	2,050	28,100	2,050	28,100	9,600	131,500	9,600	131,500	9,600	131,500	9,600	131,500	10,050	137,700	10,050	137,700
Granular Base, 100 mm	m ²	\$8	2,050	16,600	2,050	16,600	9,750	79,000	9,750	79,000	9,750	79,000	9,750	79,000	10,200	82,600	10,200	82,600
Asphalt, 50 mm	m ²	\$13	2,110	28,300	2,110	28,300	9,950	133,300	9,950	133,300	9,950	133,300	9,950	133,300	10,450	140,000	10,450	140,000
Sub Total				1,462,000		567,000		1,226,000		1,514,000		2,371,000		807,000		873,000		1,369,000
Engineering		15%		219,000		85,000		184,000		227,000		356,000		121,000		131,000		205,000
Contingency		30%		439,000		170,000		368,000		454,000		711,000		242,000		262,000		411,000
Total Component Costs				2,120,000		822,000		1,778,000		2,195,000		3,438,000		1,170,000		1,266,000		1,985,000
Separation Project Costs ⁴						2,942,000				3,973,000				4,608,000				3,251,000
Domestic Transmission Mainline																		
Ductile Pipe - 500 mm	m	\$550		-		-		-		-		-		-		-		-
Ductile Pipe - 600 mm	m	\$600		-		-		-		-		-		-		-		-
Ductile Pipe - 750 mm	m	\$650		-		-		-		-		-		-		-		-
Ductile Pipe - 900 mm	m	\$900		-		-		-		-		-		-		-		-
PVC Pipe - 900 mm	m	\$550		-		-		-		-		-		-		-		-
Sub Total				-		-		-		-		-		-		-		-
Engineering		15%		-		-		-		-		-		-		-		-
Contingency		30%		-		-		-		-		-		-		-		-
Total Component Costs				-		-		-		-		-		-		-		-
Domestic Transmission Mainline Costs						-				-				-				-

Notes:

1. Pipeline unit costs based on AECOM (2009) report
2. General costs based on percentage of work.
3. Engineering and contingency costs updated to WMP baseline values.
4. Does not include Domestic Transmission Mainline Cost

Table C.1.

Proposed New Works Required for System Separation
Water Master Plan 2012 - Greater Vernon Water Utility
2012 Costs derived from AECOM(2009) - Lavington System Se

	Unit	Unit Cost	Vimy				King Edward				Binns			
			Agricultural Only		Domestic Only		Agricultural Only		Domestic Only		Agricultural Only		Domestic Only	
			Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext
General ²														
Performance Bonds	LS	1%	1	8,400	1	8,700	1	800	1	10,800	1	10,100	1	11,400
Insurance	LS	0.5%	1	4,200	1	4,300	1	400	1	5,400	1	5,100	1	5,700
Survey and Layout	LS	0.5%	1	4,200	1	4,300	1	400	1	5,400	1	5,100	1	5,700
Water Works														
PVC Pipe - 50 mm	m	\$85		-		-		-		-		-		-
PVC Pipe - 100 mm	m	\$140		-	1,230	172,200		-	320	44,800		-	780	109,200
PVC Pipe - 150 mm	m	\$160		-	500	80,000		-		-		-		-
PVC Pipe - 200 mm	m	\$180		-		-		-		-		-	1,630	293,400
PVC Pipe - 250 mm	m	\$200		-		-		-		-	1,250	250,000		-
PVC Pipe - 300 mm	m	\$260		-		-		-		-	1,000	260,000		-
PVC Pipe - 400 mm	m	\$300		-		-		-		-	475	142,500		-
Ductile Pipe - 500 mm	m	\$550	450	247,500		-		-		-		-		-
Ductile Pipe - 600 mm	m	\$600		-		-		-		-		-		-
Ductile Pipe - 750 mm	m	\$650		-		-		-		-		-		-
Ductile Pipe - 900 mm	m	\$900		-		-		-		-		-		-
PVC Pipe - 900 mm	m	\$550		-		-		-		-		-		-
Services	ea	\$4,000		-	30	120,000		-	15	60,000		-	14	56,000
Gates Valves - 50 mm	ea	\$400		-		-		-		-		-		-
Gates Valves - 100 mm	ea	\$400		-	4	1,600		-		-		-	3	1,200
Gates Valves - 150 mm	ea	\$500		-	2	1,000		-		-		-	5	2,500
Gates Valves - 200-400 mm	ea	\$2,000		-		-		-		-	5	10,000		-
Connections - 100 pipe	ea	\$3,000		-	1	3,000		-	1	3,000		-		-
Connections - 150 pipe	ea	\$3,500		-	2	7,000		-		-		-	3	10,500
Connections - 200 pipe	ea	\$10,000		-		-		-		-		-		-
Connections - Large Pipe	ea	\$15,000		-	3	45,000		-		-		-	1	15,000
Modifications				-		-		-		-		-		-
Modifications Duteau Creek	LS	\$25,000		-		-		-		-		-		-
Modifications VonKeyserlink BS	LS	\$520,000		-		-		-		-		-		-
Decommission Lateral 1 Booster Station	LS	\$10,000		-		-		-		-		-		-
Decommission Lateral 2 Booster Station	LS	\$10,000		-		-		-		-		-		-
Abandon old Station	LS	\$5,000		-		-		-		-		-		-
Highway 6 and CN Rail Crossing	LS	\$175,000		-		-		-		-		-	1	175,000
Add PRV Station	LS	\$125,000	1	200,000		-		-		-		-		-
Domestic PRV Station	LS	\$50,000		-	1	50,000		-	1	400,000		-	1	150,000
Miscellaneous Work	LS			-		-	1	75,000		-	1	25,000		-
Road Work				-		-		-		-		-		-
Import Backfill Allowance	m ³	\$30	750	22,500	750	22,500	-	-	1,500	45,000	750	22,500	750	22,500
Asphalt Milling & Removal (100 mm depth)	m ³	\$15	1,000	15,000	1,000	15,000	-	-	1,500	22,500	850	12,800	850	12,800
Sub-Base, 300 mm depth	m ²	\$14	9,800	134,300	9,800	134,300	-	-	14,200	194,500	8,100	111,000	8,100	111,000
Granular Base, 100 mm	m ²	\$8	9,950	80,600	9,950	80,600	-	-	14,400	116,600	8,250	66,800	8,250	66,800
Asphalt, 50 mm	m ²	\$13	10,150	136,000	10,150	136,000	-	-	14,700	197,000	8,400	112,600	8,400	112,600
Sub Total				853,000		886,000		77,000		1,105,000		1,034,000		1,161,000
Engineering		15%		128,000		133,000		12,000		166,000		155,000		174,000
Contingency		30%		256,000		266,000		23,000		332,000		310,000		348,000
Total Component Costs				1,237,000		1,285,000		112,000		1,603,000		1,499,000		1,683,000
Separation Project Costs ⁴						2,522,000				1,715,000				3,182,000
Domestic Transmission Mainline														
Ductile Pipe - 500 mm	m	\$550		-		-		-		-		-		-
Ductile Pipe - 600 mm	m	\$600		-		-		-		-		-		-
Ductile Pipe - 750 mm	m	\$650		-		-		-		-		-	1,907	1,239,550
Ductile Pipe - 900 mm	m	\$900		-	1,820	1,638,000		-	2,340	2,106,000		-		-
PVC Pipe - 900 mm	m	\$550		-		-		-		-		-		-
Sub Total				-		1,638,000		-		2,106,000		-		1,240,000
Engineering		15%		-		246,000		-		316,000		-		186,000
Contingency		30%		-		491,000		-		632,000		-		372,000
Total Component Costs				-		2,375,000		-		3,054,000		-		1,798,000
Domestic Transmission Mainline Costs														7,227,000

Notes:

1. Pipeline unit costs based on AECOM (2009) report
2. General costs based on percentage of work.
3. Engineering and contingency costs updated to WMP baseline values.
4. Does not include Domestic Transmission Mainline Cost

Table C.2.
Proposed New Works Required for System Separation
2012 Costs of Agriculture Components only
Water Master Plan 2012 - Greater Vernon Water
All Agricultural Lands other than Lavington

	Unit	Unit Cost	Coldstream		Coldstream West		Hillview		South BX PZ585		South BX PZ633	
			Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext
General												
Performance Bonds	LS	1%	1	100	1	2,200	1	10,300	1	8,400	1	1,200
Insurance	LS	0.5%	1	-	1	1,100	1	5,100	1	4,200	1	600
Survey and Layout	LS	0.5%	1	-	1	1,100	1	5,100	1	4,200	1	600
Additional Water Works Required												
PVC Pipe - 50 mm	m	\$155	300	46,500		-		-		-		-
PVC Pipe - 100 mm	m	\$230		-		-		-	1,000	230,000	400	92,000
PVC Pipe - 150 mm	m	\$250		-	760	190,000	3,400	850,000	2,000	500,000		-
PVC Pipe - 200 mm	m	\$300		-		-		-		-		-
PVC Pipe - 250 mm	m	\$350		-		-		-		-		-
PVC Pipe - 300 mm	m	\$400		-		-		-		-		-
PVC Pipe - 400 mm	m	\$515		-		-		-		-		-
Ductile Pipe - 500 mm	m	\$615		-		-		-		-		-
Ductile Pipe - 600 mm	m	\$740		-		-		-		-		-
Ductile Pipe - 750 mm	m	\$890		-		-		-		-		-
Ductile Pipe - 900 mm	m	\$1,040		-		-		-		-		-
Services	ea	\$4,000	1	4,000	5	20,000	40	160,000	24	96,000	5	20,000
Gates Valves - 50 mm	ea	\$400	3	1,200		-		-		-		-
Gates Valves - 100 mm	ea	\$400		-		-		-		-	1	400
Gates Valves - 150 mm	ea	\$500		-	2	1,000	10	5,000	7	3,500		-
Gates Valves - 200-400 mm	ea	\$2,000		-		-		-		-		-
Connections - 100 pipe	ea	\$3,000		-		-		-		-	1	3,000
Connections - 150 pipe	ea	\$3,500	1	3,500	2	7,000	3	10,500	2	7,000		-
Connections - 200 pipe	ea	\$10,000		-		-		-		-		-
Connections - Large Pipe	ea	\$15,000		-		-		-		-		-
Sub Total				55,300		222,400		1,046,000		853,300		117,800
Engineering		15%		8,000		33,000		157,000		128,000		18,000
Contingency		30%		17,000		67,000		314,000		256,000		35,000
Total				80,300		322,400		1,517,000		1,237,300		170,800

Table C.2.
Proposed New Works Required for System Separation
2012 Costs of Agriculture Components only
Water Master Plan 2012 - Greater Vernon Water
All Agricultural Lands other than Lavington

	Unit	Unit Cost	Pleasant Valley		North BX PZ585		Swan Lake East		Old Kamloops	
			Qty	Ext	Qty	Ext	Qty	Ext	Qty	Ext
General										
Performance Bonds	LS	1%	1	4,800	1	4,300	1	6,400	1	2,900
Insurance	LS	0.5%	1	2,400	1	2,200	1	3,200	1	1,400
Survey and Layout	LS	0.5%	1	2,400	1	2,200	1	3,200	1	1,400
Additional Water Works Required										
PVC Pipe - 50 mm	m	\$155		-		-		-		-
PVC Pipe - 100 mm	m	\$230	290	66,700	200	46,000		-	1,030	236,900
PVC Pipe - 150 mm	m	\$250	1,200	300,000	1,200	300,000	520	130,000		-
PVC Pipe - 200 mm	m	\$300		-		-	400	120,000		-
PVC Pipe - 250 mm	m	\$350		-		-	880	308,000		-
PVC Pipe - 300 mm	m	\$400		-		-		-		-
PVC Pipe - 400 mm	m	\$515		-		-		-		-
Ductile Pipe - 500 mm	m	\$615		-		-		-		-
Ductile Pipe - 600 mm	m	\$740		-		-		-		-
Ductile Pipe - 750 mm	m	\$890		-		-		-		-
Ductile Pipe - 900 mm	m	\$1,040		-		-		-		-
Services	ea	\$4,000	24	96,000	20	80,000	10	40,000	10	40,000
Gates Valves - 50 mm	ea	\$400		-		-		-		-
Gates Valves - 100 mm	ea	\$400		-		-		-	6	2,400
Gates Valves - 150 mm	ea	\$500	8	4,000	3	1,500	3	1,500		-
Gates Valves - 200-400 mm	ea	\$2,000		-		-	3	6,000		-
Connections - 100 pipe	ea	\$3,000		-		-	3	9,000	2	6,000
Connections - 150 pipe	ea	\$3,500	3	10,500	1	3,500	1	3,500		-
Connections - 200 pipe	ea	\$10,000		-		-	1	10,000		-
Connections - Large Pipe	ea	\$15,000		-		-	1	15,000		-
Sub Total				486,800		439,700		655,800		291,000
Engineering		15%		73,000		66,000		98,000		44,000
Contingency		30%		146,000		132,000		197,000		87,000
Total				705,800		637,700		950,800		422,000

Appendix D: Agriculture Canada Crop and Irrigation System Data

Agriculture Water Demand Model

Annual Summary 1 (Irrigation and Animal Use)

13/09/2012 8:20:33 AM

Modeling Parameters

model version 2011.10.03

Modeling area: Okanagan		Run Date: 13/09/2012 8:16:46 AM
Case Study: gvwu 2003		
Description: Greater Vernon Water Utility; 1997 and 2003		
Source: D:\iwd_model\okanagan\IWDM Original Source.mdb		
Climate Scenario: actuals	Year(s): 1997,2003	
Growing Season Overrides Table: used	Irrigation Overrides: not used	Irrigation Management Practice: avg
Selection Criteria: ((outdoorUseType IN ('Agriculture','Recreation','Domestic') AND irrigUsed = 'Y' AND irrigId <> 'Blank') OR hasAnimalUse = 'Y' OR hasIndoorUse = 'Y') AND watpurvid = 'Greater Vernon Water Utility'		
Landuse Changes:		

Overall Annual Irrigation and Animal Water Demand

Year	Surface Water			Reclaimed Water			Groundwater			Crop Irrigation Totals			Animal Use Total	Grand Total
	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)	Water Demand (m3)	Water Demand (m3)
1997	2,970.2	17,006,452	573	746.4	4,417,322	592	336.6	1,750,215	520	4,053.3	23,173,989	572	157,626	23,331,614
2003	2,970.2	24,747,487	833	746.4	6,644,399	890	336.6	2,677,666	795	4,053.3	34,069,552	841	157,626	34,227,178

Irrigation Systems not currently in use (potential demand)

Irrigation System	Water Source			Total
	Surface Water Area (ha)	Reclaimed Area (ha)	Groundwater Area (ha)	
Handline	16.4	0.0	0.0	16.4
Landscapesprinkler	3.7	0.0	0.0	3.7
Sprinkler	14.0	2.5	2.6	19.0
	34.1	2.5	2.6	39.2

Animals

Year: 1997		Water Demand (m3)
Animal Type		
Beef		134,541
Dairy - dry		670
Dairy - milking		1,139
Horses		19,367
Poultry - broiler		138
Poultry - laying		73
Sheep		1,697
		157,626
Year: 2003		Water Demand (m3)
Animal Type		
Beef		134,541
Dairy - dry		670
Dairy - milking		1,139
Horses		19,367
Poultry - broiler		138
Poultry - laying		73
Sheep		1,697
		157,626

Crops

by Crop Group

Year: 1997	Surface Water			Reclaimed Water			Groundwater			Total		
	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)
Alfalfa	295.3	1,111,759	376	16.6	69,929	421	82.7	321,033	388	394.6	1,502,721	381
Apple	375.9	1,628,657	433	0.0	0	0	53.5	211,023	395	429.4	1,839,680	428
Berry	3.4	12,760	375	0.0	0	0	0.1	606	406	3.6	13,366	376
Cherry	7.8	36,875	471	0.0	0	0	0.0	0	0	7.8	36,875	471
Corn	203.5	786,491	386	0.0	0	0	0.0	0	0	203.5	786,491	386
Domestic Outdoor	1,162.2	7,917,431	681	0.0	69	736	37.2	248,186	666	1,199.4	8,165,686	681
Forage	738.8	4,331,117	586	378.3	2,304,234	609	147.4	887,241	602	1,264.4	7,522,593	595
Fruit	12.1	54,358	449	0.0	0	0	0.5	2,571	559	12.6	56,929	453
Golf	25.7	188,568	734	154.8	1,103,261	713	0.0	0	0	180.5	1,291,829	716
Grape	1.7	3,228	187	2.3	2,966	126	0.0	0	0	4.1	6,194	152
Greenhouse	1.2	28,817	2,404	0.1	1,300	1,854	0.0	0	0	1.3	30,117	2,373
Nursery	10.7	53,215	496	184.8	870,015	471	5.5	26,838	488	201.0	950,069	473
Recreational Turf	86.6	615,256	710	9.6	65,547	686	3.3	22,363	677	99.5	703,166	707
Turf Farm	15.3	111,095	725	0.0	0	0	0.0	0	0	15.3	111,095	725
Vegetable	29.9	126,826	424	0.0	0	0	6.5	30,352	469	36.4	157,178	432
	2,970.2	17,006,452	573	746.4	4,417,322	592	336.6	1,750,215	520	4,053.3	23,173,989	572
Year: 2003	Surface Water			Reclaimed Water			Groundwater			Total		
	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)
Alfalfa	295.3	1,841,729	624	16.6	114,752	691	82.7	532,832	645	394.6	2,489,314	631
Apple	375.9	2,622,135	698	0.0	0	0	53.5	340,572	637	429.4	2,962,707	690
Berry	3.4	22,368	657	0.0	0	0	0.1	1,041	698	3.6	23,409	658

Agriculture Water Demand Model - Annual Summary 1 (Irrigation and Animal Use)

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
	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)
Crop Group												
Cherry	7.8	56,804	725	0.0	0	0	0.0	0	0	7.8	56,804	725
Corn	203.5	1,336,434	657	0.0	0	0	0.0	0	0	203.5	1,336,434	657
Domestic Outdoor	1,162.2	10,751,475	925	0.0	95	1,014	37.2	348,478	936	1,199.4	11,100,048	925
Forage	738.8	6,471,030	876	378.3	3,457,946	914	147.4	1,330,757	903	1,264.4	11,259,733	891
Fruit	12.1	84,731	699	0.0	0	0	0.5	4,009	872	12.6	88,740	705
Golf	25.7	255,836	995	154.8	1,514,982	979	0.0	0	0	180.5	1,770,819	981
Grape	1.7	6,234	360	2.3	5,933	253	0.0	0	0	4.1	12,167	298
Greenhouse	1.2	32,468	2,708	0.1	1,454	2,074	0.0	0	0	1.3	33,922	2,673
Nursery	10.7	89,074	831	184.8	1,457,931	789	5.5	46,081	838	201.0	1,593,086	792
Recreational Turf	86.6	838,729	968	9.6	91,305	956	3.3	31,178	944	99.5	961,212	966
Turf Farm	15.3	155,622	1,016	0.0	0	0	0.0	0	0	15.3	155,622	1,016
Vegetable	29.9	182,816	611	0.0	0	0	6.5	42,717	660	36.4	225,533	619
	2,970.2	24,747,487	833	746.4	6,644,399	890	336.6	2,677,666	795	4,053.3	34,069,552	841

by Irrigation System

Year: 1997	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
	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)
Irrigation System												
Drip	140.0	520,292	372	66.5	219,923	331	32.5	113,003	348	239.0	853,218	357
Golf/Sprinkler	25.7	188,568	734	154.8	1,103,261	713	0.0	0	0	180.5	1,291,829	716
Gun	109.2	712,245	653	15.9	125,927	790	29.6	217,553	734	154.7	1,055,725	682
Handline	198.2	1,020,555	515	30.0	162,185	541	66.1	321,953	487	294.3	1,504,693	511
Landscapesprinkler	1,223.6	8,355,341	683	9.6	65,616	686	39.4	262,385	666	1,272.5	8,683,341	682
Microsprinkler	80.9	360,000	445	0.0	0	0	0.2	766	395	81.1	360,765	445
Overtreedrip	18.4	79,907	434	5.9	24,133	406	4.2	16,444	389	28.6	120,483	422
Pivot	120.5	437,490	363	0.0	0	0	0.0	0	0	120.5	437,490	363
SDI	20.6	78,730	382	0.0	0	0	0.0	0	0	20.6	78,730	382
Sprinkler	443.1	2,298,751	519	83.9	445,455	531	71.5	377,089	527	598.6	3,121,295	521
Ssgun	12.3	49,649	403	0.0	0	0	0.0	0	0	12.3	49,649	403
Ssovertree	46.8	253,470	542	6.0	32,523	539	2.4	13,652	571	55.2	299,646	543
Sssprinkler	28.0	135,444	484	0.0	0	0	3.8	19,039	495	31.8	154,483	486
Ssundertree	41.4	199,998	483	47.0	239,530	509	11.0	48,767	444	99.4	488,295	491
Travgun	279.6	1,370,280	490	259.9	1,627,935	626	61.6	280,076	455	601.0	3,278,291	545
Wheelline	182.1	945,733	519	66.9	370,834	554	14.2	79,488	558	263.3	1,396,056	530
	2,970.2	17,006,452	573	746.4	4,417,322	592	336.6	1,750,215	520	4,053.3	23,173,989	572

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
Irrigation System	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)
Drip	140.0	831,372	594	66.5	361,076	543	32.5	180,922	556	239.0	1,373,370	575
Golf/Sprinkler	25.7	255,836	995	154.8	1,514,982	979	0.0	0	0	180.5	1,770,819	981
Gun	109.2	1,104,222	1,012	15.9	190,361	1,195	29.6	330,807	1,117	154.7	1,625,390	1,051
Handline	198.2	1,552,044	783	30.0	250,883	837	66.1	497,867	753	294.3	2,300,794	782
Landscapesprinkler	1,223.6	11,348,658	927	9.6	91,400	956	39.4	368,331	936	1,272.5	11,808,389	928
Microsprinkler	80.9	574,139	710	0.0	0	0	0.2	1,256	648	81.1	575,395	710
Overtreedrip	18.4	125,706	683	5.9	40,221	676	4.2	26,583	628	28.6	192,510	674
Pivot	120.5	733,486	609	0.0	0	0	0.0	0	0	120.5	733,486	609
SDI	20.6	121,967	591	0.0	0	0	0.0	0	0	20.6	121,967	591
Sprinkler	443.1	3,460,547	781	83.9	688,804	821	71.5	566,712	792	598.6	4,716,064	788
Ssgun	12.3	84,003	683	0.0	0	0	0.0	0	0	12.3	84,003	683
Ssovertree	46.8	399,897	855	6.0	54,029	895	2.4	21,798	912	55.2	475,724	862
Sssprinkler	28.0	211,446	756	0.0	0	0	3.8	30,772	801	31.8	242,218	762
Ssundertree	41.4	321,891	778	47.0	403,388	858	11.0	79,070	719	99.4	804,349	809
Travgun	279.6	2,186,968	782	259.9	2,491,002	959	61.6	453,838	737	601.0	5,131,808	854
Wheelline	182.1	1,435,304	788	66.9	558,253	835	14.2	119,709	840	263.3	2,113,266	803
	2,970.2	24,747,487	833	746.4	6,644,399	890	336.6	2,677,666	795	4,053.3	34,069,552	841

by Soil Texture

Year: 1997	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
	Soil Texture	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)
Clay	511.2	2,599,640	509	103.6	595,732	575	59.4	295,685	498	674.2	3,491,057	518
Loam	587.3	2,920,673	497	29.0	206,179	711	122.5	626,710	512	738.8	3,753,562	508
Loamy Sand	30.7	217,839	711	3.2	23,811	741	1.8	13,639	751	35.7	255,288	715
Sand	2.6	14,479	555	0.0	0	0	0.0	0	0	2.6	14,479	555
Sandy Loam	1,186.6	6,926,310	584	348.0	1,987,269	571	94.2	534,813	568	1,628.8	9,448,391	580
Sandy Loam (defaulted)	600.5	4,044,534	674	260.0	1,590,099	612	35.6	176,974	497	896.1	5,811,607	649
Silt Loam	51.2	281,987	551	1.1	6,005	560	23.1	102,394	444	75.3	390,387	518
Silty Clay Loam	0.2	990	627	1.5	8,228	542	0.0	0	0	1.7	9,217	550
	2,970.2	17,006,452	573	746.4	4,417,322	592	336.6	1,750,215	520	4,053.3	23,173,989	572

Year: 2003	Water Source									Total		
	Surface Water			Reclaimed Water			Groundwater					
	Soil Texture	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)
Clay	511.2	3,858,287	755	103.6	887,979	857	59.4	441,743	743	674.2	5,188,010	770
Loam	587.3	4,498,621	766	29.0	286,596	988	122.5	966,054	789	738.8	5,751,272	778
Loamy Sand	30.7	300,853	981	3.2	32,004	996	1.8	18,465	1,017	35.7	351,322	984
Sand	2.6	22,393	859	0.0	0	0	0.0	0	0	2.6	22,393	859
Sandy Loam	1,186.6	10,213,363	861	348.0	3,079,158	885	94.2	810,322	860	1,628.8	14,102,843	866
Sandy Loam (defaulted)	600.5	5,434,770	905	260.0	2,337,236	899	35.6	283,837	797	896.1	8,055,844	899
Silt Loam	51.2	417,803	816	1.1	8,964	836	23.1	157,243	682	75.3	584,010	775
Silty Clay Loam	0.2	1,396	884	1.5	12,462	821	0.0	0	0	1.7	13,858	827
	2,970.2	24,747,487	833	746.4	6,644,399	890	336.6	2,677,666	795	4,053.3	34,069,552	841

Appendix E. Estimating System Separation Project Costs

Cost estimates for the separated system components defined in Figure A-2 are required to complete the analysis in TM9 – System Separation Options. The most complete study available was the Lavington Study (AECOM, 2009). This report provided a complete breakdown of quantities and costs for infrastructure separation in agricultural and domestic components. A key assumption is that the costs of the agricultural systems are accurate for the purposes of this planning (Table 6-2). The costs of the domestic system are unknown for several project areas.

For TM9, costs for the domestic system are also required, but little information is available without more extensive study. A study commissioned by GVW in 2003 was the only study available that examines domestic system separation. The study, however, examined domestic separation as a whole system, with a central water supply (not Duteau), and not by project area. The study also has a variety of assumptions that are inconsistent with the assumptions in this 2012 Master Water Plan.

With the use of the GVW GIS mapping, quantities from the Lavington study, accurate domestic system costs and information obtained from the 2003 study, a procedure was developed to provide defensible estimates of domestic system project costs. This appendix provides the details involved in the development of Table 7-1.

a) Rationale

Tables C1 and C2 provide detailed project estimates for the Lavington study area, which identifies detailed construction costs for the Von Keyserlingk, Springfield, Antwerp Springs, King Edward, Vimy, East Buchanan and Binns sub-areas. These estimates were developed using the Lavington System Separation Study (AECOM, 2009), and have similar design criteria and assumptions to those in this MWP.

In 2003, following the release of the NOWA MWP, Kerr Wood Leidal were commissioned by GVW to model and design a separated potable system called “System Separation Program: Hydraulic Modelling and Preliminary Engineering” by KWL (2003). The study provides pipeline quantities and detailed discussion on the capacity and costs of implementing a program to completely separate the agricultural components. The study's base assumptions were different than in this MWP, and the quantities and costs differ significantly when compared to the later Lavington estimates and West Swan Lake project currently under construction. The 2003 report does provide quantities that are useful in obtaining an estimate of the potable system requirement.

The procedure was as follows:

1. Review the two relevant system separation studies and establish the design criteria for each.
2. Revise and update the cost estimates of a past system separation report by KWL (2003) to match the design criteria of this MWP.
3. Examine the domestic system cost estimates from each study in the Lavington study area. Use recent construction cost estimates at West Swan Lake as a comparison.
4. Update the domestic project system costs in the remaining system.
5. Further break down the costs into the current 2012 MWP project areas.

b) Past Studies

Two past studies were referred to in this analysis:

- The Lavington Study (AECOM, 2009): As noted in Section 6.2, this study provides precise detail on both the agricultural and domestic system requirements to separate each system in the Lavington study area only.
- A report by KWL (2003) named “System Separation Program: Hydraulic Modelling and Preliminary Engineering” completed for GVW in December 2003. This report provided a cost estimate of a separated potable system consistent with the 2001 NOWA Master Water Plan (AE, 2001). This study extended to the entire GVW area.

The KWL (2003) report is comprehensive examination of a separated potable system based on different assumptions from this analysis. While there are many assumptions in the analysis, comparing the studies and making them useful in this analysis meant addressing some of the key differences:

- Potable water is only supplied from the Mission Hill Water Treatment Plant,
- The agricultural system is responsible for fire flow and hydrants,
- Engineering costs are 10 percent, and Contingencies are 10% of capital costs plus engineering (Total 21 percent engineering and contingencies). Parameters such as these are more typical of a Class “A” cost estimate following a tender, not for a broader project plan.
- Not all agricultural connections, including farm houses or distant domestic services were separated. These distant connections were assumed to be supplied by groundwater or “Point of Entry” treatment systems.
- The project areas were divided using a cadastral map, and not by individual projects or pressure zones.

c) Updating the KWL (2003) Report

Original tables of project costs from the KWL (2003) report are enclosed in Appendix F. In an effort to compare and update the information with this Plan, the unit costs were updated based on values from Table 3-1.

Additional effort was required to eliminate duplicate costs and updating the design criteria. These included:

- Removing the pavement costs, as this was included in the new unit costs,
- Separating out the trunk mainlines.
- All pipelines with diameters of 25 to 100 mm were upsized to the minimum 150 mm diameter required to accommodate fire flow.

Domestic transmission mainline components were removed from the Middleton estimate in the KWL report, as well as the Binns, Springfield and Von Keyserlingk estimates in AECOM (2009). The transmission mainline locations will be examined further in TM No. 9 – System Separation Options.

The project components in KWL (2003) were divided by map area, and not pressure zone. Table F-1 was used to group the systems as closely as possible to the 2012 MWP areas in Figure A-2. Results of this analysis, which include comparisons to the Lavington study as well as to current West Swan Lake construction costs, are presented in Table E-1.

The results from Table E-1 indicate that the project separation costs have approximately doubled over the last 10 years. In addition to this, the costs in the Lavington report are an additional 20 percent higher than the adjusted values (Column B – Table E-1). This increase can be attributed to more length of pipeline added to the system, as well as the addition of more expenses in road crossings, PRV upgrades and connection costs. The 20 percent estimate is also consistent in the Swan Lake West comparison, where the current construction costs at West Swan Lake System are estimated to be \$8.228M (See Table E-2).

Table E-1
Breakdown of Costs of Lavington Area Separation Projects.

Area	A	B	C
	KWL (2003) Report		Construction Costs of of Same Area from AECOM (2009) ²
	Original Construction Cost Estimate (from Table F-1) ¹	2012 - Adjusted Construction Costs (from Table F-2)	
LAVINGTON STUDY AREAS			
Binns/King Edward	973,795	1,796,900	2,266,000
Antwerp Spring/East Buchanan/Vimy	1,948,481	3,010,790	3,062,000
Von Keyserlingk	1,700	-	567,000
Springfield	976,775	1,431,200	1,514,000
Sub-Total Lavington	3,900,751	6,238,890	7,409,000
Ratio of Column C/Column B =			1.19

Notes:

1. Engineering and Contingencies Excluded
2. Domestic system component values minus the cost of transmission mainlines.

Table E-2
Analysis Verification with Actual Construction - West Swan Lake

Area	A	B	C
	KWL (2003) Report		Construction Costs of West Swan Lake Separation Project ²
	2003 Construction Cost Estimate	2012 - Adjusted Construction Cost Estimate	
WEST SWAN LAKE ³	2,704,615	4,659,950	
Engineering (15%)		698,993	
Contingencies (30%)		1,397,985	
Totals		6,756,928	8,228,000
Ratio of Column C/Column B =			1.22

Notes:

1. For Construction estimates in KWL (2003) report, see tables at end of this appendix.
2. Source - Personal correspondence with Neal Whiteside of Kerr Wood Leidal, December 2012.

d) Estimating Costs of Remaining Project Areas

The remaining project areas in this analysis were compiled and are presented in Table E-3.

Consistent with the results in Table E-1, the project costs to construct the domestic system were estimated to be 20% percent higher than the adjusted costs from the KWL (2003) report.

Table E-3
Estimated Costs of Remaining Grouped Project Areas
(Not including Transmission Costs)

A	B	C	D
Area	KWL (2003) Report		Suggested Domestic Project Cost (120% of Column C) ²
	Original Construction Cost Estimate ¹	2012 - Adjusted Construction Costs (Table F-2)	
Swan Lake East - NBX585	2,218,350	3,762,300	4,520,000
Pleasant Valley/NBX610/SBX585/SBX633	3,572,370	6,086,250	7,310,000
Hillview/SBX585	2,972,470	4,954,050	5,950,000
Middleton	1,869,695	3,054,600	3,670,000
Coldstream	690,429	1,057,485	1,270,000
West Coldstream	859,750	996,175	1,200,000
Stepping Stones/NW Swan Lake	1,196,860	1,991,300	2,390,000
Total Domestic Project Separation Component (Adjusted)	13,379,924	21,902,160	26,310,000

Notes:

1. Engineering and Contingencies Excluded
2. Bella Vista System omitted from analysis as it is already constructed.

The final step was to further refine the values determined in Table E-3 to the remaining project areas defined in this MWP. To roughly determine each project area cost, the value of agriculture infrastructure from the related areas was used from Table 6-2. This assumption provided a ratio of infrastructure within the grouped areas. Table E-4 is a summary of the results of the analysis.

Table E-4.
Estimation of New Domestic Costs for Each Project Area
(Not including Transmission Costs)

Area	Domestic	Agricultural System		Domestic
	A	B	C	D
	Grouped New Capital Costs to Separation (from Table E-3)	Agr. System Value by Area (From Table 6.2)	% of Value by Area	Estimated New Domestic Costs by Project Area (Col A * Col C)
Swan Lake East - NBX585	4,520,000			
Swan Lake East		\$4,979,000	55%	2,503,000
North BX B PZ 585		\$4,012,000	45%	2,017,000
Pleasant Valley/NBX610/SBX585/SBX633	7,310,000			
Pleasant Valley PZ 535		\$6,651,000	35%	2,576,000
North BX C PZ 610		\$3,198,000	17%	1,238,000
South BX PZ 585		\$5,854,000	31%	2,267,000
South BX PZ 633		\$3,173,000	17%	1,229,000
Hillview/SBX585	5,950,000			
Hillview (East Middleton)		\$6,805,000	100%	5,950,000
Middleton	3,670,000			
Middleton Mountain		\$3,239,000	100%	3,670,000
Coldstream	1,270,000			
Coldstream		\$4,658,000	100%	1,270,000
West Coldstream	1,200,000			
Coldstream West		\$941,000	100%	1,200,000
Stepping Stones/NW Swan Lake	2,390,000			
Stepping Stones		\$2,375,000	100%	2,390,000
Total Domestic Project Separation Component (Adjusted)	26,310,000	43,510,000		26,310,000

Table E-5
Summary of Construction Costs Required to Separate each Project Area
(Not including Transmission Costs)

Project Area	Cost of Agricultural Components	Cost of Domestic Components	Total New Capital Requirements to Separate Systems
<u>Lavington Study Area</u>			
Von Keyserlingk ¹	1,462,000	822,000	861,000
Springfield	1,226,000	1,514,000	2,740,000
Antwerp Springs	2,371,000	807,000	3,178,000
East Buchanan	873,000	1,369,000	2,242,000
Vimy	853,000	886,000	1,739,000
King Edward ²	77,000	1,105,000	1,056,000
Binns ³	1,034,000	1,161,000	2,195,000
Sub-Total Lavington Study Area	7,896,000	7,664,000	14,011,000
<u>Remaining Areas</u>			
Swan Lake East	951,000	2,503,000	3,454,000
Pleasant Valley PZ 535	706,000	2,576,000	3,282,000
North BX B PZ 585	638,000	2,017,000	2,655,000
North BX C PZ 610		1,238,000	1,238,000
South BX PZ 585	1,237,000	2,267,000	3,504,000
South BX PZ 633	171,000	1,229,000	1,400,000
Hillview (East Middleton)	1,517,000	5,950,000	7,467,000
Middleton Mountain		3,670,000	3,670,000
Coldstream	80,000	1,270,000	1,350,000
Coldstream West	322,000	1,200,000	1,522,000
Stepping Stones		2,390,000	2,390,000
Sub-Total Remaining Areas	5,622,000	26,310,000	31,932,000
Components completed to date			
Total Construction Costs	\$13,518,000	\$33,974,000	\$45,943,000
Engineering (15%)			\$6,892,000
Contingencies (30%)			\$13,783,000
Total Project Costs			\$66,618,000

Notes:

1. Von Keyserlingk project is partially complete (\$2,064,000 to date).
2. King Edward project is partially complete (\$182,210 to date). West Buchanan connections incorporated to King Edward works.
3. Binns - Transmission Mainline removed.
4. All Values summarized from Appendix F. Potable Transmission Mainlines not included.

Appendix F: Worksheets from KWL (2003)

COST ESTIMATE SUMMARY SHEETS - GVWU																												
Map Sheet	Street Name	From	To	WM Length (m)	50 (m)	100 (m)	150 (m)	200 (m)	250 (m)	300 (m)	350 (m)	400 (m)	Dom. Services Short (no.)	Dom. Services Long (no.)	Irrig. Services short (no.)	Irrig. Services Long (no.)	Connect to Exist. WM (no.)	3m width Road reconstr. (lineal m)	Serv. Trench Road reconstr. (m2)	Ex WM Crossing (no.)	Rail or Hwy Crossing (no.)	Creek Crossing (no.)	PRV Small (\$)	Bet Stn Small (\$)	LINE TOTAL	Comments		
UNIT PRICING (yellow cells)				\$	58 \$	72 \$	82 \$	105 \$	130 \$	163 \$	206 \$	249 \$	750 \$	1,065 \$	1,000 \$	1,300 \$	1,700 \$	65.00 \$	20.00 \$	600.00 \$	60,000 \$	75,000 \$	35,000 \$	300,000 \$				
82L-15-4-4	Duteau Creek Intake		NO WORKS REQ'D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	-		
82L-15-4-4	Okanagan Landing		SUBTOTALS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	82L-15-4-4	
CAPITAL COST TOTAL				\$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	\$	-
82L-24-1-3	Bellevista Road (covered on Sheet 24-3-1)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	-		
82L-24-1-3	Okanagan Landing		SUBTOTALS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	82L-24-1-3	
CAPITAL COST TOTAL				\$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	\$	-
82L-24-1-4	No Works Required			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	-		
82L-24-1-4	Central Okanagan Landing		SUBTOTALS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	82L-24-1-4	
CAPITAL COST TOTAL				\$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	\$	-
82L-24-2-1	Coldstream Creek Rd			0	0	0	0	0	0	0	0	0	0	7	0	0	1	0	58	0	0	0	0	0	\$	10,275.00	Services and Connections	
82L-24-2-1	Cunliffe Rd			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	5,100.00		
82L-24-2-1	Cunliffe Road Reservoir Pipeworks			50	0	0	0	0	50	0	0	0	0	0	0	0	2	50	0	0	0	0	0	0	\$	73,150.00	Allowance for controls included	
82L-24-2-1	Kal Lake Pump Station & Distribution Main			295	0	0	0	0	295	0	0	0	0	0	0	0	2	295	0	0	0	0	0	0	\$	360,925.00	Kal Lake PShn PZ 463 to PZ 500	
82L-24-2-1	Kildonan Road			175	0	0	0	0	175	0	0	0	0	0	0	0	2	175	0	0	0	0	0	0	\$	68,150.00		
82L-24-2-1	Pothway Drive East and West			0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	32	0	0	0	1	1	\$	342,150.00	PShn PZ500-545	
82L-24-2-1	South Coldstream		SUBTOTALS	520	0	0	0	0	175	345	0	0	0	3	11	0	0	10	520	88	0	0	2	2	2	\$	859,750.00	82L-24-2-1
CAPITAL COST TOTAL				\$	- \$	- \$	- \$	- \$	18,375 \$	44,850 \$	- \$	- \$	- \$	2,250 \$	11,715 \$	- \$	- \$	17,000 \$	33,800 \$	1,760 \$	- \$	- \$	- \$	- \$	70,000 \$	660,000 \$	\$	859,750.00
82L-24-2-2	Coldstream Creek Rd	Kal Rd	Cosens Bay Rd	680	290	0	0	370	0	0	0	0	0	4	1	0	5	680	32	0	0	0	0	0	\$	112,970.00	Incl. additional conn.	
82L-24-2-2	Cosens Bay Rd	Cosens Crk. Rd	South lot	0	0	0	0	0	0	0	0	0	5	3	0	0	1	0	24	2	0	0	0	0	\$	235,325.00	Local Pmp Stn PZ 500-535	
82L-24-2-2	Greave Dr	Cosens Bay Rd	East lot	300	300	0	0	0	0	0	0	0	1	1	0	0	1	300	8	0	0	0	0	0	\$	40,575.00		
82L-24-2-2	Howe Dr	Kal Rd	South lot	767	347	420	0	0	0	0	0	0	2	0	0	0	1	767	0	0	0	0	0	0	\$	103,421.00		
82L-24-2-2	Kal Rd	Giles Dr	West lot	1000	0	0	0	1000	0	0	0	0	0	0	0	0	2	970	0	0	0	0	0	0	\$	171,450.00		
82L-24-2-2	Coldstream		SUBTOTALS	2727	937	420	0	1370	0	0	0	0	8	8	1	0	10	2697	64	2	0	0	0	0	0	\$	663,741.00	82L-24-2-2
CAPITAL COST TOTAL				\$	54,346 \$	30,240 \$	- \$	143,850 \$	- \$	- \$	- \$	- \$	6,000 \$	8,520 \$	1,000 \$	- \$	17,000 \$	175,305 \$	1,280 \$	1,200 \$	- \$	- \$	- \$	- \$	225,000 \$	\$	663,741.00	
82L-24-2-3	1000mm Lake Intake Pipe, 2200 metres			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	1,320,000.00	Lake intake pipe, \$600/metre	
82L-24-2-3	750mm WM KAL PShn to WTP 660m			860	0	0	0	0	0	0	0	0	0	0	0	0	0	860	0	0	0	0	0	0	\$	602,000.00	trunk main, \$700/metre	
82L-24-2-3	WM From NOWA 300 to Kal Lake PShn			2575	0	0	0	0	0	0	0	0	2575	0	0	0	0	2575	0	2	1.5	1.5	0	0	\$	1,012,250.00		
82L-24-2-3	Middleton Mtn conversion		SUBTOTALS	3435	0	0	0	0	0	0	0	0	2575	0	0	0	0	3435	0	2	1.5	1.5	0	0	0	\$	2,934,250.00	82L-24-2-3
CAPITAL COST TOTAL				\$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	- \$	641,175 \$	- \$	- \$	- \$	- \$	- \$	223,275 \$	- \$	1,200 \$	90,000 \$	112,500 \$	- \$	- \$	\$	2,934,250.00	
82L-24-2-4	Aberdeen Rd			0	0	0	0	0	0	0	0	0	5	0	0	0	2	0	0	0	0	0	0	0	\$	7,150.00	Connections	
82L-24-2-4	Binns Rd	Buchanan Rd	W page limit	1180	0	0	0	1180	0	0	0	0	6	3	2	1	0	1180	32	2	0	0	0	0	\$	213,435.00		
82L-24-2-4	Buchanan Branch	Buchanan Rd	South lot	240	240	0	0	0	0	0	0	0	1	2	2	1	0	240	24	1	0	0	0	0	\$	36,780.00		
82L-24-2-4	Buchanan Rd	Binns Rd	Nickel Rd	660	0	0	0	660	0	0	0	0	0	4	0	0	1	660	32	1	0	0	0	0	\$	119,400.00		
82L-24-2-4	Buchanan/N. Aberdeen			470	0	470	0	0	0	0	0	0	2	3	0	0	1	470	24	0	0	0	0	1.5	\$	521,265.00	Bet Stn PZ 535-585	
82L-24-2-4	Cypress Drive	E page limit	N page limit	1810	0	0	0	1810	0	0	0	0	0	0	0	0	0	1810	0	1	0	0	0	0	\$	308,300.00	New Irrig. Main	
82L-24-2-4	Grey Rd	Hwy 6	E page limit	290	0	0	290	0	0	0	0	0	1	0	1	0	1	290	0	0	0	0	0	0	\$	46,080.00		
82L-24-2-4	Hwy 6	Aberdeen Rd	West limit	430	0	0	430	0	0	0	0	0	1	0	2	0	2	430	0	0	0	0	0	0	\$	69,360.00	New Irrig. Main	
82L-24-2-4	Mather Ln	Aberdeen Rd	West lot	540	0	540	0	0	0	0	0	0	3	1	0	3	1	540	32	1	0	0	0	0	\$	84,135.00		
82L-24-2-4	Middleton Road	Sarsons Rd	to the west	190	0	190	0	0	0	0	0	0	3	0	0	0	0	190	0	1	0	0	0	0	\$	28,880.00		
82L-24-2-4	Nickel Rd	Buchanan Rd	South lots	570	0	570	0	0	0	0	0	0	12	0	0	0	0	570	0	1	0	0	0	0	\$	87,690.00		
82L-24-2-4	Rendell Dr	Heritage Lane	Railway	720	0	0	720	0	0	0	0	0	3	6	0	1	2	720	56	0	0	0	0	0	\$	120,309.00		
82L-24-2-4	Rendell Dr	Aberdeen	Heritage Lane	200	0	0	200	0	0	0	0	0	0	0	3	0	2	200	0	0	0	0	0	0	\$	40,400.00	New Irrig. Main	
82L-24-2-4	Sarsons Rd	Middleton Dr	North lot	750	0	0	750	0	0	0	0	0	7	3	0	2	1	750	40	0	0	0	0	0	\$	123,795.00		
82L-24-2-4	Venables Dr	Middleton Main	Rock Outcropping	220	0	220	0	0	0	0	0	0	4	1	1	0	1	220	8	0	0	0	0	0	\$	37,065.00		
82L-24-2-4	Central Coldstream		SUBTOTALS	8270	240	1990	2190	3850	0	0	0	0	48	23	11	8	14	8270	248	8	0	0	0	0	1.5	\$	1,844,035.00	82L-24-2-4
CAPITAL COST TOTAL				\$	13,920 \$	143,280 \$	179,580 \$	404,250 \$	- \$	- \$	- \$	- \$	36,000 \$	24,495 \$	11,000 \$	10,400 \$	23,800 \$	537,550 \$	4,960 \$	4,800 \$	- \$	- \$	- \$	- \$	450,000 \$	\$	1,844,035.00	
82L-24-3-1	Bella Vista Rd	E page limits	S page limit	920	0	0	180	740	0	0	0	0	0	3	0	0	3	920	24	0	0	0	0	0	\$	161,035.00		
82L-24-3-1	Bella Vista		SUBTOTALS	920	0	0	180	740	0	0	0	0	0	3	0	0	3	920	24	0	0	0	0	0	\$	161,035.00	82L-24-3-1	
CAPITAL COST TOTAL				\$	- \$	- \$	14,760 \$	77,700 \$	- \$	- \$	- \$	- \$	- \$	3,195 \$	- \$	- \$	- \$	5,100 \$	59,800 \$	480 \$	- \$	- \$	- \$	- \$	- \$	\$	161,035.00	
82L-24-3-2	Davidson Rd	Bella Vista Rd	W page limit	1020	0	1020	0	0	0	0	0	0	2	4	0	0	1	1020	32	1	0	0	0	0	\$	148,440.00		
82L-24-3-2	Bella Vista Rd			1780	0	0	0	0	0	1780	0	0	8	12	1	2	8	1780	112	3	0	0	0	0	\$	445,860.00	Various Pieces (Dom.)	
82L-24-3-2	Bella Vista Rd			1360	0	0	0	310	0	1070	0	0	0	0	0	0	8	1380	0	1	0	0	0	0	\$	310,860.00	Various Pieces (Irrig.)	
82L-24-3-2	Skyview Rd	Bella Vista Rd	South lot	210	210	0	0	0	0	0	0	0	1	1	0	0	0	210	8	0	0	0	0	0	\$	27,805.00		
82L-24-3-2	Scott Rd ROW	Bella Vista Rd	Scott Rd	820	0	160	660	0	0	0	0	0	0	0	0	0	0	820	0	1	0	0	0	0	\$	119,540.00	New Irrig. Main	
82L-24-3-2	Scott Rd			310	0	310	0	0	0	0	0	0	2	0	1	0	1	310	6	0	0	0	0	0	\$	46,670.00	Section of Scott Rd	
82L-24-3-2	Bella Vista		SUBTOTALS	5520	210	1490	660	310	0	2850	0	0	13	17	2	2	18	5520	152	6	0	0	0	0	0	\$	1,099,175.00	82L-24-3-2
CAPITAL COST TOTAL				\$	12,160 \$	107,280 \$	54,120 \$	32,550 \$	- \$	464,550 \$	- \$	- \$	9,750 \$	18,105 \$	2,000 \$	2,600 \$	30,600 \$	358,800 \$	3,040 \$	3,600 \$	- \$	- \$	- \$	- \$	- \$	\$	1,099,175.00	
82L-24-4-1	32nd Ave	Near 41St		90	90	0	0	0	0	0	0	0	1	0	0	0	1	90	0	0	0	0	0	0	\$	13,520.00		
82L-24-4-1	43rd Ave	Ex 450m Main		130	0	0	0	0	130	0	0	0	0	0	0	0	1											

COST ESTIMATE SUMMARY SHEETS - GVWU																											
				COST_MASTER3.xls										20-Oct-03 RJH													
Map Sheet	Street Name	From	To	WM Length (m)	50 (m)	100 (m)	150 (m)	200 (m)	250 (m)	300 (m)	350 (m)	400 (m)	Dom. Services Short (no.)	Dom. Services Long (no.)	Irrig. Services short (no.)	Irrig. Services Long (no.)	Connect to Exist. WM (no.)	3m width Road reconstr. (lineal m)	Serv. Trench Road reconstr. (m2)	Ex WM Crossing (no.)	Rail or Hwy Crossing (no.)	Creek Crossing (no.)	PRV Small (\$)	Bst Stn Small (\$)	LINE TOTAL	Comments	
UNIT PRICING (yellow cells)					\$ 58	\$ 72	\$ 82	\$ 105	\$ 130	\$ 163	\$ 206	\$ 249	\$ 750	\$ 1,065	\$ 1,000	\$ 1,300	\$ 1,700	\$ 65.00	\$ 20.00	\$ 600.00	\$ 60,000	\$ 75,000	\$ 35,000	\$ 300,000			
82L-24-4-3	BX Rd	at Pleasant Valley		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	\$ 1,700.00	Connection		
82L-24-4-3	Goose Lake Rd	Old Kamloops Rd	N page limit	190	0	190	0	0	0	0	0	0	0	0	0	0	1	190	0	0	0	0	0	\$ 27,730.00	New Irrig. Main		
82L-24-4-3	Lafay Rd	at Pleasant Valley	West lot	80	80	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	\$ 12,690.00			
82L-24-4-3	Old Kamloops Rd	at Pleasant Valley	N page limit	3120	0	0	0	0	0	0	0	0	0	0	0	0	0	3120	168	0	0	0	0	\$ 655,225.00			
82L-24-4-3	Pearson Rd	Silver Star Rd	North lot	160	0	160	0	0	0	0	0	0	1	0	0	1	0	160	0	0	0	0	0	\$ 23,270.00	New Irrig. Main		
82L-24-4-3	Pleasant Valley Rd	River Rd	N page limit	1250	0	0	0	0	1250	0	0	0	12	27	6	9	2	1250	288	0	0	0	0	\$ 308,385.00			
82L-24-4-3	Pleasant Valley Rd	River Rd	Silver Star Rd	820	0	0	820	0	0	0	0	0	1	5	0	0	1	820	40	1	0	0	0	\$ 129,715.00	New Irrig. Main		
82L-24-4-3	Right of Way	Old Kamloops Rd	Cardinal Rd	330	0	330	0	0	0	0	0	0	0	0	1	0	1	330	0	0	0	0	0	\$ 47,910.00			
82L-24-4-3	Right of Way	River Rd	20 St	300	0	0	0	0	0	300	0	0	0	0	0	0	2	300	0	0	0	0	1.5	0	1.33	583,300.00	Crk Crossing - BstStn PZ 483-510
82L-24-4-3	West Swan Lake			6250	80	680	820	0	4370	300	0	0	33	53	11	9	11	6250	496	3	0	0	1.5	0	1.33	1,789,905.00	82L-24-4-3
CAPITAL COST TOTAL				\$ 4,940	\$ 48,960	\$ 67,240	\$ -	\$ 568,100	\$ 48,900	\$ -	\$ -	\$ 24,750	\$ 56,445	\$ 11,000	\$ 11,700	\$ 18,700	\$ 406,250	\$ 9,920	\$ 1,800	\$ -	\$ 112,500	\$ -	\$ 399,000	\$ -	\$ 1,789,905.00		
82L-24-4-4	Butters Rd	River Rd	North lot	320	0	0	320	0	0	0	0	0	0	0	3	4	1	320	32	0	0	0	0	\$ 57,580.00	New Irrig. Main		
82L-24-4-4	BX Road	Cascade		245	0	0	245	0	0	0	0	0	0	0	0	0	0	245	0	0	0	0	0	\$ 36,015.00			
82L-24-4-4	Deroo Rd	Dixon Dam Rd	S page limit	1100	130	890	80	0	0	0	0	0	4	4	3	2	0	1100	48	1	0	0	0	\$ 164,100.00	Both Branches off Dixon Dam		
82L-24-4-4	Dixon Dam Rd	East Vernon Rd	North lot	2160	340	1680	140	0	0	0	0	0	11	13	0	2	1	2160	120	1	0	0	1	\$ 621,955.00	Bst Stn PZ 586-610		
82L-24-4-4	Duncan Rd	Silver Star Rd	West lot	110	110	0	0	0	0	0	0	0	1	0	0	0	0	110	0	1	0	0	0	\$ 14,880.00			
82L-24-4-4	East Dedecker	Silver Star Rd	West lot	150	150	0	0	0	0	0	0	0	0	2	0	0	1	150	16	1	0	0	0	\$ 23,200.00			
82L-24-4-4	East Vernon Rd	Silver Star Rd	East lot	160	160	0	0	0	0	0	0	0	1	0	0	1	0	160	8	0	0	0	0	\$ 21,890.00			
82L-24-4-4	East Vernon Rd	S page limit	Past Hughes Rd	1870	360	0	210	1300	0	0	0	0	17	9	0	1	2	1870	80	2	0	0	0	\$ 325,985.00			
82L-24-4-4	Herry Rd			0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	24	0	0	0	0	\$ 3,675.00	Dom. Services		
82L-24-4-4	Hughes Road	Dixon Dam Rd	East lot	220	220	0	0	0	0	0	0	0	2	2	0	0	0	220	16	1	0	0	0	\$ 31,610.00			
82L-24-4-4	Kruger Rd	L&A Rd	West lot	150	150	0	0	0	0	0	0	0	1	0	0	0	0	150	0	0	0	0	0	\$ 19,200.00			
82L-24-4-4	L&A Rd	Silver Star Rd	N page limit	1820	0	0	150	1670	0	0	0	0	10	20	2	4	1	1820	192	3	0	0	0	\$ 349,290.00			
82L-24-4-4	Lane	West of BX Road		245	245	0	0	0	0	0	0	0	1	0	0	0	0	245	0	0	0	0	0	\$ 30,885.00			
82L-24-4-4	MacDonald Rd	River Rd	Silver Star Rd	0	0	0	0	0	0	0	0	0	0	16	0	0	2	0	144	0	0	0	0	\$ 25,450.00	Dom. Services/Conn.		
82L-24-4-4	MacDonald Rd	River Rd	Silver Star Rd	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	24	0	0	0	0	\$ 3,675.00	Irrig. Services		
82L-24-4-4	Mallin Rd	Dixon Dam Rd	West lot	250	250	0	0	0	0	0	0	0	3	1	0	1	0	250	16	0	0	0	0	\$ 36,685.00			
82L-24-4-4	Pleeger Rd	East Vernon Rd	North lot	720	0	720	0	0	0	0	0	0	5	4	0	0	1	720	32	0	0	0	0	\$ 106,990.00	New Irrig. Main		
82L-24-4-4	River Rd	MacDonald Rd	Past Apple Lane	1570	110	0	0	1460	0	0	0	0	12	13	0	0	2	1570	104	2	0	0	1.5	\$ 741,255.00	Bst Stn PZ 510-560		
82L-24-4-4	River Rd	L&A Rd	West lot	170	0	0	0	0	0	0	0	0	2	3	0	0	1	170	0	0	0	0	0	\$ 28,190.00			
82L-24-4-4	Silver Star Rd	W page limit	MacDonald Rd	340	0	0	340	0	0	0	0	0	2	3	0	0	2	340	24	0	0	0	0	\$ 56,855.00	New Irrig. Main		
82L-24-4-4	Silver Star Rd	MacDonald Rd	Past L&A Rd	1280	0	0	1140	0	140	0	0	0	16	8	0	1	4	1280	72	1	0	0	0	\$ 225,540.00			
82L-24-4-4	Silver Star Rd	L&A Rd	East Dedecker	940	170	0	770	0	0	0	0	0	1	10	0	0	2	940	80	1	0	0	0	\$ 151,100.00	New Irrig. Main (Incl. Barker Rd)		
82L-24-4-4	Silver Star Rd	East Dedecker	Near Grey Canal Rd	1050	0	1050	0	0	0	0	0	0	17	8	0	2	2	1050	80	1	0	0	0	\$ 173,320.00			
82L-24-4-4	Star Rd	Silver Star Rd	North lot	1100	0	340	760	0	0	0	0	0	2	0	7	0	2	1100	0	0	0	0	0	\$ 170,200.00			
82L-24-4-4	West Dedecker Rd	McClure	West lot	270	0	270	0	0	0	0	0	0	2	3	1	0	1	270	24	0	0	0	0	\$ 44,865.00			
82L-24-4-4	NBX			16240	2395	4950	4325	4430	140	0	0	0	110	124	16	18	24	16240	1136	15	0	0	0	2.5	3,465,390.00	82L-24-4-4	
CAPITAL COST TOTAL				\$ 138,910	\$ 356,400	\$ 354,650	\$ 465,150	\$ 18,200	\$ -	\$ -	\$ -	\$ -	\$ 82,500	\$ 132,060	\$ 16,000	\$ 23,400	\$ 40,800	\$ 1,055,600	\$ 22,720	\$ 9,000	\$ -	\$ -	\$ -	\$ 750,000	\$ -	3,465,390.00	
82L-25-1-1	Brewer Rd West	Hwy 6	E page limit	550	0	550	0	0	0	0	0	0	1	1	2	2	1	550	24	0	0	0	0	\$ 83,945.00	No Rd (right of way)		
82L-25-1-1	Coldstm Ranch Rd	Hwy 6	South lot	170	170	0	0	0	0	0	0	0	3	0	0	0	1	170	0	1	0	0	0	\$ 25,460.00			
82L-25-1-1	Kalamalka Rd	Hwy 6	W page limit	350	0	0	350	0	0	0	0	0	1	1	0	0	1	350	8	1	0	0	0	\$ 56,725.00			
82L-25-1-1	South Coldstream Valley			1070	170	550	350	0	0	0	0	0	5	2	2	2	3	1070	32	2	0	0	0	0	165,130.00	82L-25-1-1	
CAPITAL COST TOTAL				\$ 9,860	\$ 39,600	\$ 28,700	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 3,750	\$ 2,130	\$ 2,000	\$ 2,600	\$ 5,100	\$ 69,550	\$ 640	\$ 1,200	\$ -	\$ -	\$ -	\$ -	\$ -	165,130.00	
82L-25-1-2	Brewer Road	Hwy 6	Mid-Junction	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	\$ 3,490.00			
82L-25-1-2	Brewer Road West	Brewer Rd	W page limit	650	0	650	0	0	0	0	0	0	5	0	0	0	0	650	0	0	0	0	0	\$ 92,800.00			
82L-25-1-2	Leamouth Road	Coldstm crk	N page limit	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	\$ 1,500.00			
82L-25-1-2	Warren Road	Hwy 6	N page limit	210	0	0	210	0	0	0	0	0	0	0	0	0	1	210	0	0	1	0	0	\$ 92,570.00			
82L-25-1-2	South Coldstream Valley			860	0	650	210	0	0	0	0	0	7	0	0	0	3	860	0	0	1	0	0	\$ 190,270.00	82L-25-1-2		
CAPITAL COST TOTAL				\$ -	\$ 46,800	\$ 17,220	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,250	\$ -	\$ -	\$ -	\$ 5,100	\$ 55,900	\$ -	\$ -	\$ 60,000	\$ -	\$ -	\$ -	\$ -	190,270.00	
82L-25-1-3	Binns Rd	Ricardo	W page limit	90	0	0	0	90	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	\$ 15,300.00			
82L-25-1-3	Buchanan Rd	E page limit	Grey Rd	3560	0	0	3560	0	0	0	0	0	21	0	0	0	0	3560	0	4	0	0	0	\$ 623,350.00			
82L-25-1-3	Grey Rd	Buchanan Rd	W page limit	730	0	0	450	280	0	0	0	0	6	0	0	6	0	730	48	2	0	0	0	\$ 128,210.00			
82L-25-1-3	Ricardo Rd	Buchanan Rd	South lot	200	200	0	0	0	0	0	0	0	0	1	1	0	0	200	8	1	0	0	0	\$ 27,425.00			
82L-25-1-3	North Coldstream Valley			4580	200	0	450	3930	0	0	0	0	27	1	1	6	0	4580	56	7	0	0	0	\$ 794,285.00	82L-25-1-3		
CAPITAL COST TOTAL				\$ 11,600	\$ -	\$ 36,900	\$ 412,650	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 20,250	\$ 1,065	\$ 1,000	\$ 7,800	\$ -	\$ 297,700	\$ 1,120	\$ 4,200	\$ -	\$ -	\$ -	\$ -	\$ -	794,285.00	
82L-25-1-4	Buchanan Road	Hwy 6	W page limits	3430	0	0	3430	0	0	0	0	0	17	9	0	0	1	3430	72	4	0	0	1	\$ 832,085.00	Bst Stn PZ 585-640		
82L-25-1-4	Buchanan Road	Buchanan Rd	North lot	250	250	0	0	0	0	0	0	0	0	0	0	0	0	250	0	0	0	0	0	\$ 30,750.00			
82L-25-1-4	Hwy 6	at Coldstm	private lot	80	80	0	0	0	0	0	0	0	0	0	0	0	0	80	0	1	1.5	0	0	\$ 100,440.00			
82L-25-1-4	Leamouth Rd	Leamouth	West lot	200	200	0	0	0	0	0	0	0	1	0	0	0	1	200	0	0	0	0	0	\$ 27,050.00			
82L-25-1-4	Reid Road	Leamouth	E page limit	300	0	300	0	0	0	0	0	0	0	0	0	0	1	300	0	0	0	0	0	\$ 42,800.00			
82L-25-1-4	Warren Road	B																									

GVWU COST MASTER SUMMARY SHEET

COST ESTIMATE SUMMARY SHEETS - GVWU																									COST_MASTER3.xls										20-Oct-03 RJH																				Comments
Map Sheet	Street Name	From	To	WM Length (m)	50 (m)	100 (m)	150 (m)	200 (m)	250 (m)	300 (m)	350 (m)	400 (m)	Dom. Services Short (no.)	Dom. Services Long (no.)	Irrig. Services short (no.)	Irrig. Services Long (no.)	Connect to Exst. WM (no.)	3m width Road reconstr. (lineal m)	Serv. Trench Road reconstr. (m2)	Ex WM Crossing (no.)	Rail or Hwy Crossing (no.)	Creek Crossing (no.)	PRV Small (\$)	Est Stn Small (\$)	LINE TOTAL																														
UNIT PRICING (yellow cells)				\$	58	\$	72	\$	82	\$	105	\$	130	\$	163	\$	206	\$	249	\$	750	\$	1,065	\$	1,000	\$	1,300	\$	1,700	\$	65.00	\$	20.00	\$	600.00	\$	60,000	\$	75,000	\$	35,000	\$	300,000												
82L-34-2-2	Grey Canal Rd	McLennan Rd	South lot	360	180	180	0	0	0	0	0	0	8	1	3	0	0	0	360	8	0	0	0			\$	57,025.00	Incl. converted services Est Stn PZ 560-610																											
82L-34-2-2	Herry Rd	Pleasant Valley	Holtbrook Rd	1060	240	270	550	0	0	0	0	0	0	8	0	0	3	1060	64	1	0	0			\$	162,860.00																													
82L-34-2-2	L&A Rd	N page limit	S page limit	2720	0	0	2720	0	0	0	0	0	32	19	4	5	4	2720	192	0	0	0		1.25	\$	840,215.00																													
82L-34-2-2	McLennan Rd	L&A Rd	Grey Canal Rd	260	0	260	0	0	0	0	0	0	0	0	0	0	0	260	0	2	0	0			\$	36,820.00																													
82L-34-2-2	Pleasant Valley Rd	Hwy 97	Meadowlark Rd	360	0	0	0	360	0	0	0	0	1	4	0	0	2	360	32	2	0	0			\$	71,450.00	New Irrig. Main/Conn. Dom. Conn/Services																												
82L-34-2-2	Pleasant Valley Rd	Hwy 97	Meadowlark Rd	0	0	0	0	0	0	0	0	0	0	9	0	0	2	0	72	2	0	0			\$	15,825.00																													
82L-34-2-2	Pleasant Valley Rd	Herry Rd	W page limit	150	0	0	0	150	0	0	0	0	2	20	0	0	1	150	160	1	0	0			\$	53,800.00																													
82L-34-2-2	Swan Lake East - Mid Level		SUBTOTALS	4910	420	710	3270	510	0	0	0	0	43	61	7	5	12	4910	528	8	0	0		1.25	\$	1,237,795.00	82L-34-2-2																												
CAPITAL COST TOTAL				\$	24,360	\$	51,120	\$	268,140	\$	53,550	\$	-	\$	-	\$	-	\$	-	\$	32,250	\$	64,965	\$	7,000	\$	6,500	\$	20,400	\$	319,150	\$	10,580	\$	4,800	\$	-	\$	-	\$	-	\$	375,000	\$	1,237,795.00										
82L-34-2-3	Hwy 97	Spall Boundary	E page limit	1120	0	0	0	1120	0	0	0	0	0	0	0	0	0	0	1120	0	0	0	0			\$	190,400.00	Est Stn. PZ 483-518																											
82L-34-2-3	Hwy 97	N page limit	GVWU Boundary	1110	0	110	270	730	0	0	0	0	0	0	1	0	0	2	0	1	0	0			\$	111,775.00																													
82L-34-2-3	Old Kamloops Rd	Spall Boundary	S page limit	1790	0	0	0	0	1790	0	0	0	12	19	4	4	4	1790	184	1	0	0			\$	691,765.00																													
82L-34-2-3	North West Swan Lake		SUBTOTALS	4020	0	110	270	1850	1790	0	0	0	12	20	4	4	2	2910	184	2	0	0		0	1	\$	993,940.00		82L-34-2-3																										
CAPITAL COST TOTAL				\$	-	\$	7,920	\$	22,140	\$	194,250	\$	232,700	\$	-	\$	-	\$	-	\$	9,000	\$	21,300	\$	4,000	\$	5,200	\$	3,400	\$	189,150	\$	3,680	\$	1,200	\$	-	\$	-	\$	-	\$	300,000	\$	993,940.00										
82L-34-2-4	Baker Hogg Rd	Glenhayes Rd	L&A Rd	790	0	0	790	0	0	0	0	0	4	10	0	1	0	0	790	88	0	0	0			\$	132,840.00	New Irrig. Main New Irrig. Main																											
82L-34-2-4	Glenhayes Rd	Baker Hogg Rd	North lot	530	0	530	0	0	0	0	0	0	5	6	1	0	0	530	48	1	0	0			\$	85,310.00																													
82L-34-2-4	Highland Rd	Hwy 97	South lot	250	0	250	0	0	0	0	0	0	2	0	0	0	1	250	0	1	0	0			\$	38,050.00																													
82L-34-2-4	Hwy 97	Along Hwy	-	350	0	180	170	0	0	0	0	0	3	0	0	0	1	350	0	0	0	0			\$	53,600.00																													
82L-34-2-4	Hwy 97/Pleasant Valley	W page limit	S page limit	2240	0	0	0	2240	0	0	0	0	9	9	2	4	5	2240	104	3	1	0			\$	476,715.00	Incl. conversion conn.																												
82L-34-2-4	L&A Rd	Baker Hogg Rd	S page limit	450	0	0	450	0	0	0	0	0	9	3	0	0	3	450	24	0	0	0			\$	81,675.00																													
82L-34-2-4	McKoryk Rd	L&A Rd	East lot	220	0	0	220	0	0	0	0	0	3	1	0	0	1	220	16	1	0	0			\$	37,875.00																													
82L-34-2-4	Pleasant Valley	South Section	-	110	0	0	0	110	0	0	0	0	0	0	0	0	1	110	0	1	0	0			\$	21,000.00	New Irrig. Main																												
82L-34-2-4	Ridgeview Rd	Baker Hogg Rd	North lot	150	150	0	0	0	0	0	0	0	2	0	0	1	1	150	8	0	0	0			\$	23,110.00																													
82L-34-2-4	Swan Lake East - North End		SUBTOTALS	5090	150	960	1630	2350	0	0	0	0	37	29	3	7	12	5090	288	7	1	0		0	0	\$	950,175.00	82L-34-2-4																											
CAPITAL COST TOTAL				\$	8,700	\$	69,120	\$	133,660	\$	246,750	\$	-	\$	-	\$	-	\$	-	\$	27,750	\$	30,885	\$	3,000	\$	9,100	\$	20,400	\$	330,850	\$	5,760	\$	4,200	\$	60,000	\$	-	\$	-	\$	-	\$	950,175.00										
82L-34-4-1	Hwy 97	North lot	S page limit	1270	500	770	0	0	0	0	0	0	5	0	0	0	0	0	2	1	0	0			\$	149,390.00	Stepping Stones																												
82L-34-4-1	Right of way	Hwy 97	West lot	390	390	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0			\$	23,370.00																													
82L-34-4-1	Stepping Stones		SUBTOTALS	1660	890	770	0	0	0	0	0	0	6	0	0	0	0	0	2	1	0	0		0	0	\$		172,760.00	82L-34-4-1																										
CAPITAL COST TOTAL				\$	51,620	\$	55,440	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	4,500	\$	-	\$	-	\$	-	\$	-	\$	1,200	\$	60,000	\$	-	\$	-	\$	-	\$	-	\$	-	\$	172,760.00										

COST ESTIMATE SUMMARY SHEETS - GVWU																																TOTAL COST
Map Sheet	Location	WM Length (m)	50 (m)	100 (m)	150 (m)	200 (m)	250 (m)	300 (m)	350 (m)	400 (m)	Dom. Services Short (no.)	Dom. Services Long (no.)	Irrig. Services short (no.)	Irrig. Services Long (no.)	Connect to Exist. WM (no.)	Ex WM Crossing (no.)	Ex WM Crossing (no.)	Ex WM Crossing (no.)	Rail or Hwy Crossing (no.)	Creek Crossing (no.)	PRV Small (\$)	Est Stn Small (\$)										
82L-24-1-3	Okanagan Landing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	-							
82L-24-1-4	Central Okanagan Landing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	\$	-							
82L-24-2-1	South Coldstream	520	0	0	0	175	345	0	0	0	3	11	0	0	10	520	88	0	0	0	0	2	2.2	\$	859,750.00							
82L-24-2-2	Coldstream	2727	937	420	0	1370	0	0	0	0	8	8	1	0	10	2697	64	2	0	0	0	0	0.75	\$	663,741.00							
82L-24-2-3	Feed to WTP	3435	0	0	0	0	0	0	0	2575	0	0	0	0	0	3435	0	2	1.5	1.5	0	0	0	\$	2,834,250.00							
82L-24-2-3a	Middleton Mtn conversion	0																			8			\$	380,000.00							
82L-24-2-4	Central Coldstream	8270	240	1990	2190	3850	0	0	0	0	48	23	11	8	14	8270	248	8	0	0	0	1.5		\$	1,844,035.00							
82L-24-3-1	Bella Vista	920	0	0	180	740	0	0	0	0	0	3	0	0	3	920	24	0	0	0	0	0	0	\$	161,035.00							
82L-24-3-2	Bella Vista	5520	210	1490	660	310	0	2850	0	0	13	17	2	2	18	5520	152	6	0	0	0	0	0	\$	1,099,175.00							
82L-24-4-1	NE Vernon	660	90	440	0	0	130	0	0	0	3	1	0	0	4	660	8	1	0	0	0	0	0	\$	107,575.00							
82L-24-4-2	East Vernon	13000	850	1170	7090	3470	420	0	0	0	69	74	6	10	13	13000	672	19	0	0	0	2.5		\$	2,940,370.00							
82L-24-4-3	West Swan Lake	6250	80	680	820	0	4370	300	0	0	33	53	11	9	11	6250	496	3	0	1.5	0	1.33		\$	1,789,905.00							
82L-24-4-4	NBX	16240	2395	4950	4325	4430	140	0	0	0	110	124	16	18	24	16240	1136	15	0	0	0	2.5		\$	3,465,390.00							
82L-25-1-1	South Coldstream Valley	1070	170	550	350	0	0	0	0	0	5	2	2	2	3	1070	32	2	0	0	0	0	0	\$	165,130.00							
82L-25-1-2	South Coldstream Valley	860	0	650	210	0	0	0	0	0	7	0	0	0	3	860	0	0	1	0	0	0	0	\$	190,270.00							
82L-25-1-3	North Coldstream Valley	4580	200	0	450	3930	0	0	0	0	27	1	1	6	0	4580	56	7	0	0	0	0	0	\$	794,285.00							
82L-25-1-4	North Coldstream Valley	5518	530	1130	3858	0	0	0	0	0	22	9	0	3	4	5518	96	6	1.5	0	0	1		\$	1,219,431.00							
82L-25-2-1	East Coldstream	3280	0	3080	200	0	0	0	0	0	12	12	0	0	0	3280	96	4	0	0	0	0	0	\$	477,460.00							
82L-25-2-2	East Coldstream	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	\$	1,700.00							
82L-25-2-3	East Coldstream	3840	250	1080	2510	0	0	0	0	0	21	17	3	2	4	3840	152	5	1	0	0	1		\$	959,975.00							
82L-34-2-1	West Swan Lake	3860	460	290	0	0	3110	0	0	0	40	27	3	3	1	3860	240	5	0	0	0	0	0	\$	777,915.00							
82L-34-2-2	Swan Lake East - Mid Level	4910	420	710	3270	510	0	0	0	0	43	61	7	5	12	4910	528	8	0	0	0	1.25		\$	1,237,795.00							
82L-34-2-3	North West Swan Lake	4020	0	110	270	1850	1790	0	0	0	12	20	4	4	2	2910	184	2	0	0	0	1		\$	993,940.00							
82L-34-2-4	Swan Lake East - North End	5090	150	960	1630	2350	0	0	0	0	37	29	3	7	12	5090	288	7	1	0	0	0	0	\$	950,175.00							
82L-34-4-1	Stepping Stones	1660	890	770	0	0	0	0	0	0	6	0	0	0	0	0	0	2	1	0	0	0	0	\$	172,760.00							
	CAPITAL COST TOTAL	0	8700	69120	133660	246750	0	0	0	0	27750	30895	3000	9100	20400	330850	5760	4200	60000	0	0	0	0									
	SUBTOTALS	96230	7872	20470	28013	22985	10305	3150	0	2575	539	492	70	79	149	93430	4560	104	7	3	10	15.03										

Source - KWL (2003) System Separation Program: Hydraulic Modelling and Preliminary Engineering

Area	Water Main Length (m)								Services				Connections to Existing WM	3m Width Road Rework (m)	Service Trench Road Rework (m²)	Ex WM Crossing	Railway or Hwy Crossing	Creek Crossing	PRV (Small)	Booster Stn	Trunk Mainline	Extension
	50	100	150	200	250	300	350	400	Domestic (short)	Domestic (Long)	Irrigation (Short)	Irrigation (Long)										
Unit Costs	\$58	\$72	\$82	\$105	\$130	\$163	\$206	\$249	\$750	\$1,065	\$1,000	\$1,300	\$1,700	\$65	\$20	\$600	\$60,000	\$75,000	\$35,000	\$300,000		
Okanagan Landing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Central Okanagan Landing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		-
South Coldstream	0	0	0	175	345	0	0	0	0	3	11	0	0	10	520	88	0	0	2	2.2		859,750
Coldstream	937	420	0	1370	0	0	0	0	8	8	1	0	10	2697	64	2	0	0	0	0.75		663,741
Feed to WTP (Transm. Main)	0	0	0	0	0	0	0	2575	0	0	0	0	0	0	2575	0	2	1.5	0	0		1,012,250
Middleton Mtn Conversion (Transmission Mainline)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	\$1,922,000	2,202,000
Central Coldstream	240	1990	2190	3850	0	0	0	0	48	23	11	8	14	8270	248	8	0	0	0	1.5		1,844,035
Bella Vista	0	0	180	740	0	0	0	0	0	3	0	0	3	920	24	0	0	0	0	0		161,035
Bella Vista	210	1490	660	310	0	2850	0	0	13	17	2	2	18	5520	152	6	0	0	0	0		1,099,175
NE Vernon	90	440	0	0	130	0	0	0	3	1	0	0	4	660	8	1	0	0	0	0		107,575
East Vernon	850	1170	7090	3470	420	0	0	0	89	74	6	10	13	13000	672	19	0	0	0	2.5		2,940,370
West Swan Lake	80	680	820	0	4370	300	0	0	33	53	11	9	11	6250	496	3	0	1.5	0	1.33		1,789,905
NBX	2395	4950	4325	4430	140	0	0	0	110	124	16	18	24	16240	1136	15	0	0	0	2.5		3,465,390
South Coldstream Valley	170	550	350	0	0	0	0	0	5	2	2	2	3	1070	32	2	0	0	0	0		165,130
South Coldstream Valley	0	650	210	0	0	0	0	0	7	0	0	0	3	860	0	0	1	0	0	0		190,270
North Coldstream Valley	200	0	450	3930	0	0	0	0	27	1	1	6	0	4580	56	7	0	0	0	0		794,285
North Coldstream Valley	530	1130	3858	0	0	0	0	0	22	9	0	3	4	5518	96	6	1.5	0	0	1		1,219,431
East Coldstream	0	3080	200	0	0	0	0	0	12	12	0	0	0	3280	96	4	0	0	0	0		477,460
East Coldstream	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		1,700
East Coldstream	250	1080	2510	0	0	0	0	0	21	17	3	2	4	3840	152	5	1	0	0	1		959,975
West Swan Lake	460	290	0	0	3110	0	0	0	40	27	3	3	1	3860	240	5	0	0	0	0		777,915
Swan Lake East - Mid Level	420	710	3270	510	0	0	0	0	43	61	7	5	12	4910	528	8	0	0	0	1.25		1,237,795
North West Swan Lake	0	110	270	1850	1790	0	0	0	12	20</												

Original Source - KWL (2003) System Separation Program: Hydraulic Modelling and Preliminary Engineering

Area	Water Main Length (m) (Costs include Hydrant and valves)								Services				Connections to Existing WM	3m Width Road Rework (m)	Service Trench Road Rework (m²)	Ex WM Crossing	Railway or Hwy Crossing	Creek Crossing	PRV (Small)	Booster Stn	Trunk Mainline	Extension
	50	100	150	200	250	300	350	400	Domestic (short)	Domestic (Long)	Irrigation (Short)	Irrigation (Long)										
Unit Costs	\$155	\$230	\$250	\$300	\$350	\$400	\$465	\$515	\$4,000	\$4,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$50,000	\$300,000		
Okanagan Landing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
Central Okanagan Landing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
South Coldstream	0	0	0	175	345	0	0	0	3	11	0	0	10	520	88	0	0	0	2	2.2	989,250	
Coldstream	0	0	1357	1370	0	0	0	0	8	8	1	0	10	2697	64	2	0	0	0	0.75	1,039,250	
Feed to WTP (Transmission Main)	0	0	0	0	0	0	0	2575	0	0	0	0	0	2575	0	2	1.5	1.5	0	0	1,326,125	
Middleton Mtn Conversion (Transmission Mainline)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	\$1,922,000	
Central Coldstream	0	0	4420	3850	0	0	0	0	48	23	11	8	14	8270	248	8	0	0	0	1.5	2,994,000	
Bella Vista	0	0	180	740	0	0	0	0	0	3	0	0	3	920	24	0	0	0	0	0	279,000	
Bella Vista	0	0	2360	310	0	2850	0	0	13	17	2	2	18	5520	152	6	0	0	0	0	1,943,000	
NE Vernon	0	0	530	0	130	0	0	0	3	1	0	0	4	660	8	1	0	0	0	0	194,000	
East Vernon	0	0	9110	3470	420	0	0	0	89	74	6	10	13	13000	672	19	0	0	0	2.5	4,867,500	
West Swan Lake	0	0	1580	0	4370	300	0	0	33	53	11	9	11	6250	496	3	0	1.5	0	1.33	2,787,500	
NBX	0	0	11670	4430	140	0	0	0	110	124	16	18	24	16240	1136	15	0	0	0	2.5	5,981,500	
South Coldstream Valley	0	0	1070	0	0	0	0	0	5	2	2	2	3	1070	32	2	0	0	0	0	295,500	
South Coldstream Valley	0	0	860	0	0	0	0	0	7	0	0	0	3	860	0	0	1	0	0	0	243,000	
North Coldstream Valley	0	0	650	3930	0	0	0	0	27	1	1	6	0	4580	56	7	0	0	0	0	1,453,500	
North Coldstream Valley	0	0	5518	0	0	0	0	0	22	9	0	3	4	5518	96	6	1.5	0	0	1	1,803,500	
East Coldstream	0	0	3280	0	0	0	0	0	12	12	0	0	0	3280	96	4	0	0	0	0	916,000	
East Coldstream	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-	
East Coldstream	0	0	3840	0	0	0	0	0	21	17	3	2	4	3840	152	5	1	0	0	1	1,412,000	
West Swan Lake	0	0	750	0	3110	0	0	0	40	27	3	3	1	3860	240	5	0	0	0	0	1,544,000	
Swan Lake East - Mid Level	0	0	4400	510	0	0	0	0	43	61	7	5	12	4910	528	8	0	0	0	1.25	2,044,000	
North West Swan Lake	0	0	380	1850	1790	0	0	0	12	20	4	4	2	2910	184	2	0	0	0	1	1,704,500	
Swan Lake East - North End	0	0	2740	2350	0	0	0	0	37	29	3	7	12	5090	288	7	1	0	0	0	1,654,000	
Stepping Stones	0	0	1660	0	0	0	0	0	6	0	0	0	0	0	0	2	1	0	0	0	439,000	
Total Quantities	0	0	56355	22985	10305	3150	0	2575	539	492	70	79	149	92570	4560	104	7	3	10	15.03		
Sub-Total Costs	-	-	14,088,750	6,895,500	3,606,750	1,260,000	-	1,326,125	2,156,000	1,968,000	-	-	-	-	-	-	-	-	500,000	4,509,000	1,922,000	38,232,125
Engineering Contingency																					15%	5,734,819
Total Cost																					30%	13,190,083
																						57,157,027

Appendix G: City of Vernon - Wastewater Quality Guidelines