DISTRICT OF LAKE COUNTRY

WOODSDALE RANCH

WATER SUPPLY STUDY

JANUARY 2004

Mould Engineering

District of Lake Country

WOODSDALE RANCH

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1. INTRODUCTION

A community plan amendment and rezoning application have been submitted to the District of Lake Country for the proposed Woodsdale Ranch golf course and residential resort. The proposed development is not included in the District's OCP; therefore, it was not considered in the draft Master Water Servicing Plan (MWSP). This preliminary report, prepared for the District of Lake Country, details the options investigated to supply the domestic and irrigation water requirements of the Woodsdale Ranch development. The Terms of Reference for the Study are contained in Annex 1.

Woodsdale Ranch is located on the upper hillside lands directly east of the south end of Wood Lake, as shown on the Key Map opposite. The ranch covers 531.5 ha of dry land between the Wood Lake Water System and Alto Utility.

The proposed development, outlined in a report by New Town Planning and Bel MK, dated March 2003, will comprise three principle land uses: irrigated agricultural at the lower elevations, a 27-hole golf course at the mid elevations, and a residential development at the upper elevations. The golf course area and lower elevations are within the Agricultural Land Reserve (ALR). It has been stated in the development plan submitted that approval has been received from the ALR Commission for golf course recreational use within the ALR.

In the present Winfield Okanagan Centre Water System (WOCWS), the highest hydraulic gradeline that services domestic connections is approximately 615 m; therefore, the maximum elevation of property that can be supplied with adequate pressure is about 570 m. The residential development in Woodsdale Ranch is proposed between the elevations of 660 m and 900 m, and as such will require pumping to provide a water supply.

Over a 10-year span, the Woodsdale Ranch development is proposed to include the following:

Land Use		**Area Requiring Water**
156.40 ha	Agricultural Land (126 ha Irrigated)	126 ha
132.57 ha	Private Recreation (Golf Course assumed 60 ha Irrigated)	60 ha
88.05 ha	Single Family Residential (485 units)	88 ha
12.15 ha	Low Density Multi Family/Vacation (170 units)	12 ha
10.10 ha	Public Park (assumed 5 ha irrigated)	5 ha
	Total	291 ha

It should be noted that the development plan submitted to the District of Lake Country stated an area of 80 ha for the golf course, and included 45 Country Residential lots. Experience with similar golf course developments in the Okanagan has shown that 60 ha (150 ac) of irrigated land is typical for a 27-hole course, therefore, water demands have been calculated using this value. The Country Residential lots were planned for the most easterly and highest elevated lands of the development. Preliminary calculations showed that water supply to this area was going to be costly and when discussed with the developers' consultant, it was concluded that the Country Residential lots would be excluded from the study.

The developer has proposed to supply irrigation water from a private well located near the south end of Wood Lake. A study was completed by Bel·MK Engineering Ltd. to assess the quantity and quality of water available in the proposed irrigation supply well. A long-term yield of 90 lps (2,553 Igpm) was determined based on data obtained from a three day pump test. However, it was stated in the report that aquifer flow 'is thought to be towards the north'. This suggests that the aquifer contributes to the Kalamalka-Wood Lake basin, which has virtually reached its licensed limit. Partially as a result of this finding, investigations into a possible source of supply for the irrigation component of the Woodsdale Ranch development has been added to this study.

2. DESIGN CRITERIA

The criteria used to calculate water demands and analyze possible supply options for the development include both standard design values and values recommended in the draft Master Water Servicing Plan prepared for the District. Some of the applicable criteria are shown in the table below.

Table 1
Design Criteria

	Metric Units	American Units
1. Maximum Day Demand		
a.) Agricultural and Parks	47* – 61 lpm/ha	5* – 6.5 USgpm/acre
b.) Single Family Residential	7.2 lpm/conn	1.9 USgpm/conn
c.) Multi-Family Residential	3.8 lpm/conn	1.0 USgpm/conn
d.) Commercial, Industrial & Institutional	15.3 lpm/ha	10 USgpm/acre
2. Peak Hour Demand		
a.) Single Family Residential	11.4 lpm/conn	3.0 USgpm/conn
b.) Multi-Family Residential	6.0 lpm/conn	1.6 USgpm/conn
c.) Commercial, Industrial & Institutional	24.5 lpm/ha	16.0 USgpm/acre
3. Annual Use		
a.) Agricultural and Parks	6.9 da m^3/ha	2.25 ac·ft/ac
b.) Single Family Residential	0.75 da m^3/conn	0.60 ac·ft/conn
c.) Multi-Family Residential	0.17 da m^3/conn	0.14 ac·ft/conn
d.) Commercial, Industrial & Institutional	.018 da m^3/conn	0.14 ac·ft/conn
4. Fire Flows – Minimum		
a.) Urban Residential	60 lps	950 USgpm
b.) Multi-Family	150 lps	2400 USgpm
c.) Commercial/Institutional	150 lps	2400 USgpm
5. Reservoir Storage		
a.) Fire Flow	Largest Flow x Duration	
b.) Balancing	25% of Residential Peak Day Demand	
c.) Emergency	25% of a.) and b.)	
6. System Pressures		
a.) Maximum	965 kPa	140 psi
b.) Minimum @ Peak Hour	250 kPa	36 psi
c.) Minimum at hydrant during fire	140 kPa	20 psi
7. Maximum Pipeline Velocities		
a.) Peak Hour	2.0 m/s	6.5 ft/s
b.) Peak Day plus Fire Flow	4.0 m/s	13 ft/s
8. Maximum PRV Velocities		
a.) Peak Hour	6 m/s	20 ft/s
b.) Maximum Day plus Fire Flow	7.6 m/s	25 ft/s

* The agricultural water demand is based on soil duty maps prepared by the Ministry of Agriculture.

3. WOODSDALE RANCH WATER DEMANDS

.1 *Domestic Demands*

The domestic water requirements for the proposed Woodsdale Ranch development are based on two phases of development. Phase 1 will occur between elevations 660 m and 730 m and consist of 170 multi family units, and 165 single-family units, and 5 ha of public park. Phase 2 is situated between elevations 730 and 900, and consists of the remaining 320 single-family units.

1. Maximum Day Demand

Phase 1

165 Single Family Units @ 10,400 lpd	1.72 Mlpd	
170 Multi Family Units @ 5400 lpd	0.92 Mlpd	
5 ha Public Park @ 80,600 lpd	0.40 Mlpd	
	3.04 Mlpd	

Phase 2

320 Single Family Units @ 10,400 lpd	***3.33 Mlpd***	
Full Build Out		***6.37 Mlpd***

2. Peak Hour Demand

Phase 1

165 Single Family Units @ 11.4 lpm ÷ 60	31 lps	
170 Multi Family Units @ 6.0 lpm ÷ 60	17 lps	
5 ha Public Park @ 56 lpm ÷ 60	5 lps	
	53 lps	

Phase 2

320 Single Family Units @ 11.4 lpm ÷ 60	***62 lps***	
Full Build Out		***115 lps***

3. Annual Use

Phase 1

165 Single Family Units @ 0.75 da m^3	125 da m^3	
170 Multi Family Units @ 0.17 da m^3	30 da m^3	
5 ha Public Park @ 6.9 da m^3	35 da m^3	
	190 da m3	

Phase 2

320 Single Family Units @ 0.75 da m^3	***240 da m^3***	
Full Build Out		***430 da m^3***

.4 Fire Flow

Multi-Family (Phase 1)	***150 lps @ 2.0 hrs***
Single Family (Phase 2)	***60 lps @ 1.5 hrs***

.5 Pumping Rate: $\frac{6.37 \text{ Mlpd} \div 86400 \text{ sec/d}}{18 \text{ hr}} =$ ***100 lps***

.2 *Irrigation Demands*

The development proposal estimates 126 ha (311 ac) of agricultural land, and a golf course with an irrigated area of 60 ha (150 ac). The golf course is planned to occur in Phase 1 of the development, and is situated between elevations 580 m and 660m.

1. Maximum Day Demand

Golf Course, 60 ha @ 56 lpm/ha ÷ 60	56 lps
Agricultural, 126 ha @ 56 lpm/ha ÷ 60	119 lps
	175 lps

2. Annual Demand

Golf Course, 60 ha @ 6.9 da m^3/ha	414 da m^3
Agricultural, 126 ha @ 6.9 da m^3/ha	866 da m^3
	1280 da m^3

4. WATER SUPPLY REQUIREMENTS & AVAILABILITY

1. *Water Use and Availability*

Woodsdale Ranch development is centrally located between four possible water sources. In order to determine which source can supply the development, the water use and availability from each has been calculated and is summarized below.

.1 *Winfield Okanagan Centre Water System*

WOCWS uses two water sources; approximately 90 % of annual supply is taken from Vernon Creek, which is gravity supplied from a hydraulic grade line of approximately 615 m. Okanagan Lake, the other source, is at elevation 342 m. Water is pumped from the lake to a Balancing Reservoir at elev. 536 m. Water from Okanagan Lake is supplied to Woodsdale Road, and can also be pumped to the equivalent hydraulic grade line as the Vernon Creek supply using the PR No. 24 booster pump. Availability of water from these two sources is as follows:

.1.1 *Vernon Creek*

Total Water Licenses	9,440 da m^3
Estimated Peak Annual Use	-6,530 da m^3
Water Available Under Water Licenses	***2,910 da m^3***

.1.2 *Vernon Creek Hydrology*

Watershed Yield, 49 years in 50 (WIB-1977)

Beaver Lake Watershed	9,870 da m^3
Less Fish Flows & Other Licenses (DLC estimate)	-1,480 da m^3
Less Operational Waste	-700 da m^3
Available Yield	*7,690 da m^3*
Estimated Peak Annual Use	-6,530 da m^3
Water Available in Low Flow Year Runoff	***1,160 da m^3***

Year 2003 Measured Water Use 5,000 da m^3

.1.3 *Okanagan Lake*

Total Water Licenses	8,790 da m^3
Estimated Peak Annual Use	1,200 da m^3
Available	***7,590 da m^3***
Water Use in 2003	808 da m^3

The Estimated water use from the Okanagan Lake System is based on year round supply to the following areas:

City of Kelowna	550 da m^3
Town Centre/Lower Woodsdale	600 da m^3
McCoubray Road	50 da m^3
Total	***1,200 da m^3***

.2 *Wood Lake Water System*

WLWS is supplied from Oyama Creek with the majority of storage on Oyama Lake and a lesser amount on Damer Lake. An intake on Oyama Creek provides a gravity supply to the hillside east of Wood Lake with a hydraulic grade line of approximately 610 m.

.2.1 *Oyama Creek Watershed*

Total Water Licenses	3,890 da m^3
Estimated Peak Annual Use	3,020 da m^3
Available	***870 da m^3***
Water Use in 2003	*2,460 da m^3*

The estimated low flow yield (Ref WIB, 1987) is 4440 da m^3, so the watershed yield exceeds the amount that authorized for diversion under the water licenses. However, no further licenses can be obtained (Ref Water BC 2001) as the Kal-Wood Basin is fully recorded

.3 *Oyama Water System*

The Oyama Water System is supplied by pumping from Kalamalka Lake. The water licenses and estimated water use calculate as follows:

.1 *Kalamalka Lake*

Total Water Licenses	1,695 da m^3
Estimated Peak Annual Use	1,365 da m^3
Available	*330 da m^3*
Water Use in 2003	*966 da m^3*

2. *Growth and Water Demand Projections*

The Official Community Plan (OCP) for the District of Lake Country, accepted by Council in February 2002, projected that the District's total population will rise from approximately 10,000 in year 2001 to about 17,000 in year 2020. Based on an average of 2.7 capita per housing unit, it is estimated that approximately 2,750 new housing units will be built by year 2020, and 3,100 will be needed by 2024. Of these new housing units, it is projected that 80 %, or 2,480, will be built in the area supplied by the WOCWS. It is further estimated that approximately 20 % of the new housing within WOCWS in year 2024 will be multi-family housing. This is slightly more than the 10% estimated in the OCP.

In Section 3 (Agriculture) of the OCP, Item 8 states that "The District will ensure that water supply is reserved for agricultural use". The OCP does not provide an estimate of the amount of water that should be 'reserved', and does not specify whether the water must be supplied from Vernon and Oyama Creek Watersheds or Okanagan Lake. Discussions with DLC Planning and Engineering staff suggest that the economics of agriculture are such as that the costs of pumping water from Okanagan Lake to agriculture land use are too high to consider, so agricultural water reservation must be made on Vernon and Oyama Creeks. The amount of 'dry' agricultural land within the WOCWS that can benefit from irrigation is

somewhat limited, so an amount of 690 da m^3 (100 ha of land) over the next 20 years is considered reasonable. This amount does not include the Woodsdale Ranch irrigation requirement.

It is assumed that most of the new housing units will be constructed on 'dry' land, (land not currently supplied with irrigation or domestic water). Based on the foregoing assumptions, the amount of water that the WOCWS will need to supply in Year 2024 is shown in the following table.

Table 2

Estimated additional Water Supply Requirements – Years 2004 – 2024

CATEGORY	Number of Units			Unit Rate da m^3	Total Amount da m^3
	Vernon Creek System	OkanaganLake	Total		
1. Residential					
Irrigated to Residential					
Single Family	80	0	80	0	0
Multi Family	20	0	20	0.17	4
Dry Land to Residential					
Single Family	0	1,900	1,900	0.75	1425
Multi Family	0	480	480	0.30	144
	Area (hectares)				
3. Irrigation	100	0	100	6.9	690
4. Commercial & Industrial and Institutional	0	10	10	6.9	69
5. Total					*2332*

The estimate in Table 2 shows that an additional 694 da m^3 of water will be needed from the Vernon Creek source. The current 'surplus' is estimated to be 1,160 da m^3 . so Vernon Creek will still have some reserve capacity. The Okanagan Lake source will need to supply an additional 1,638 da m^3. The peak pumping rate needed to provide that amount is about 260 lps. It will be necessary to bring one of the spare 750 hp pumps in the Okanagan Lake Pump Station into service. Some electrical

and mechanical system upgrading is necessary to operate the pump without excessive water hammer on start-up and shut-down. Also, the Master Water Servicing Plan identified that the balancing reservoir would need to be increased in size by 2,600 cubic metres if the pumping rate is increased.

5 DOMESTIC WATER SUPPLY OPTIONS

.1 *General*

In accordance with the terms of reference, this section outlines options to supply water to the domestic component of Woodsdale Ranch only as the developer has proposed to supply irrigation water from a private well near the south end of Wood Lake. Irrigation supply is discussed in Section 6. Following are descriptions and preliminary cost estimates for domestic water supply options excluding land acquisition costs. Cost estimate details are provided in Annex 2 and 3, and maps are shown opposite the description in each option.

The potential sources of domestic water that have been considered for Woodsdale Ranch include the following:

Option 1 - Okanagan Lake
Option 2 - Vernon Creek
Option 3 - Oyama Lake (Clark Creek)
Option 4 - Wood Lake Water System (Oyama Creek)

Of the sources listed above, only Okanagan Lake water meets all of the Guidelines (with disinfection) for Canadian Drinking Water Quality (GCDWQ). All other sources require treatment in addition to disinfection to meet drinking water standards.

Water from Oyama Creek, Oyama Lake, and Vernon Creek exceed drinking water standards for colour and turbidity through all or part of the year, and the aesthetic temperature objective for temperature ($\leq$ 15°C) is often exceeded during July and August.

500 D.I. PR 24

400 D.I.

300 PVC

400 PVC

UPGRADE
300 PVC

PRV

350

300 PVC

LODGE ROAD 300 PVC

200

SHERMAN ROAD
400 PVC

300 PVC

300 PVC

WOODSDALE ROAD

WOOD LAKE

RESERVOIR & BOOSTER
STATION. ELEV. 525m

300 DI

TREWHITT RD

150mm

OYAMA RD

150mm

TREWHITT RD E

150mm

200mm

PRESSURE
RELIEF

PRV

800 STEEL MAINLINE

PR NO. 2

RESERVOIR & BOOSTER
STATION. ELEV. 650m

PHASE 1
SINGLE FAMILY

PHASE 2
SINGLE FAMILY

MULTI FAMILY

250 DI

RANGE LAND

RESERVOIR
ELEV. 940m

RESERVOIR & BOOSTER
STATION. ELEV. 770m

BEAVER LAKE ROAD

CLARK CREEK

WOODSDALE RANCH BOUNDARY

PR NO.1

LEGEND:

OPTION 1 WORKS

YEAR 2020 WORKS

EXISTING WORKS

Mould Engineering

DRAWN	R.J.
DESIGN	R.J.
APPROVED	
DATE	JAN. 2004
SCALE	1:15,000

DISTRICT OF LAKE COUNTRY

WOODSDALE RANCH WATER SUPPLY FROM OKANAGAN LAKE OPTION 1

DLC–WR1

5.2 *Option 1 - Okanagan Lake Supply*

As mentioned previously, Okanagan Lake water meets GCDWQ standards requiring only disinfection. The District holds adequate water licenses on Okanagan Lake to supply domestic and irrigation requirements of the Woodsdale Ranch development, however, due to the differences in elevation, pumping costs from Okanagan Lake will be significant.

The most efficient means of supplying Okanagan Lake water to the Woodsdale Ranch development involves extending a proposed pipeline, which the District is committed to construct to supply the Eldorado Ranch development; thus this option could not proceed until that pipeline is in place. The Woodsdale Ranch developer would then be responsible for the construction of the pipeline from the Eldorado Ranch property, along road right of ways, to the first Woodsdale Ranch balancing reservoir and booster station at a hydraulic grade line of approximately 525 m. Another balancing reservoir and booster station at approximately 620 m would lift water to the first domestic supply reservoir at 770 m to supply Phase 1 of Woodsdale Ranch. A third booster station would lift water to the second domestic supply reservoir at 940 m to allow Phase 2 of development to proceed.

Annual operating costs include operation and maintenance of three booster stations, four reservoirs, and a portion of the existing works that precede the proposed works. Energy costs are a significant portion of the annual cost of this option as water must be lifted from Okanagan Lake, at 342 m, to Okanagan Lake Reservoir from which it will gravity feed to the first balancing reservoir and booster station at 525 m. The overall lift, not considering head losses, is approximately 600 m (1960 ft).

Estimated Capital Cost	***$ 5,750,000***
Estimated Annual Operating Cost	***$ 200,000***

PR 24

PUMP STATION

1.0ML RESERVOIR

TREATMENT PLANT

800 STEEL MAINLINE

300 DOM.

CLARK CREEK

DETAIL
1:7,500

800 STEEL MAINLINE

300mm DI DOMESTIC SUPPLY

PR NO. 2

BEAVER LAKE ROAD

ELDORADO RESERVOIR SITE, SEE DETAIL

CLARK CREEK

PR NO.1

LODGE ROAD

SHERMAN ROAD

WOODSDALE ROAD

WOOD LAKE

2.1ML RESERVOIR
ELEV. 770m

1.3ML RESERVOIR
ELEV. 940

250mm DI

PHASE 1
SINGLE FAMILY

PHASE 2
SINGLE FAMILY

MULTI FAMILY

RANGE LAND

TREWHITT RD

OYAMA RD

TREWHITT RD E

PRESSURE RELIEF

150mm

200mm

WOODSDALE RANCH BOUNDARY

LEGEND:

OPTION 2 WORKS

EXISTING WORKS

Mould Engineering

DRAWN	R.J.
DESIGN	J.G.
APPROVED	
DATE	JAN. 2004
SCALE	1:15,000

DISTRICT OF LAKE COUNTRY

WOODSDALE RANCH WATER SUPPLY FROM VERNON CREEK OPTION 2

DLC–WR2

5.3 *Option 2 - Vernon Creek Supply*

The discussion and calculations contained in Section 4 indicate that Vernon Creek has enough surplus capacity to supply the residential component of Woodsdale Ranch. The long range plan for development within the WOCWS system is based on the premise that lands low in elevation and close to Okanagan Lake will gradually be transferred from the Vernon Creek System to the Okanagan Lake System. Lands higher in elevation, such as Woodsdale Ranch, should be supplied from Vernon Creek in order to reduce pumping costs. The draft Master Water Servicing Plan and the DCC servicing strategy is based on supplying areas such as the Town Centre, lower Woodsdale, Okanagan Centre Road, and Harwood/Mountainview from Okanagan Lake. So while this option uses Vernon Creek as the Water source, an equivalent number of units will be transferred from the Vernon Creek System to the Okanagan Lake System thereby not increasing the demand on Vernon Creek. The cost of transferring areas will be included in the DCC program.

An important consideration in the Vernon Creek supply option is water quality. In the last decade, 10 boil water advisories have been issued for the WOCWS. As mentioned earlier, approximately 90 % of water in WOCWS is supplied from Vernon Creek, which is susceptible to high colour and turbidity during spring runoff and storm events. Full treatment is necessary to meet GCDWQ throughout the year.

To supply the domestic component of Woodsdale Ranch from Vernon Creek with water that meets or exceeds GCDWQ, construction of a treatment plant, finished water reservoir and booster station at the Eldorado Reservoir site is required. A pipeline would run north to the Woodsdale Ranch property. The booster station at the treatment plant site would lift water to the first domestic reservoir at 770 m where a second booster station would lift water to the upper domestic reservoir at 940 m.

Operating costs include the cost of power to boost from the finished water reservoir to Woodsdale domestic reservoirs and the cost associated with pumping an equivalent volume of water from Okanagan Lake to Okanagan Lake Reservoir to compensate for the loss of water supply from Vernon Creek.

Estimated Capital Cost	***$ 8,000,000***
Estimated Annual Operating Cost	***$ 240,000***

.1 *Vernon Creek without Treatment*

If full treatment of Vernon Creek water is not deemed necessary, Okanagan Lake water could be pumped to the finished water reservoir during freshet to minimize colour and turbidity experienced by domestic consumers. Under this scenario, costs are estimated as follows:

Estimated Capital Cost	***$ 4,950,000***
Estimated Annual Operating Costs	***$ 125,000***

PHASE 1 SINGLE FAMILY

PHASE 2 SINGLE FAMILY

MULTI FAMILY

RANGE LAND

RESERVOIR ELEV. 770m

WOODSDALE RANCH BOUNDARY

WATER TREATMENT / DISINFECTION PLANT & SETTLING POND. ELEV 950m RESERVOIR ELEV. 940m

SCREENING BUILDING & INTAKE POND. ELEV 1120m

CLARK CREEK

TREWHITT RD E

PRESSURE RELIEF

PRV 8

PRV NO. 9

PRV NO. 7

PRV NO. 6

PRV NO. 5

PRV NO. 4

MIDDLE BENCH RD.

TALBOT ROAD

PRESSURE TANK

BOOSTER STATION

RIBBLEWORTH CREEK

WLID BOUNDARY

OYAMA LAKE RO

EASTHI

LEGEND:

OPTION 3 WORKS

EXISTING WORKS

Mould Engineering

DRAWN	R.J.
DESIGN	J.G.
APPROVED	
DATE	JAN. 2004
SCALE	1:15,000

DISTRICT OF LAKE COUNTRY

WOODSDALE RANCH
WATER SUPPLY FROM CLARK CREEK
OPTION 3

DLC-WR3

5.4 Option 3 - Clark Creek (Oyama Lake) Supply

.1 Clark Creek With Treatment

Clark Creek, which only flows significantly when Oyama Lake levels are high, is the closest potential gravity water supply to Woodsdale Ranch. In a report prepared by Mould Engineering in 1997, samples collected at the Oyama Lake outlet from April through December 1996 showed an average colour of 42 TCU and average turbidity of 0.89 NTU.

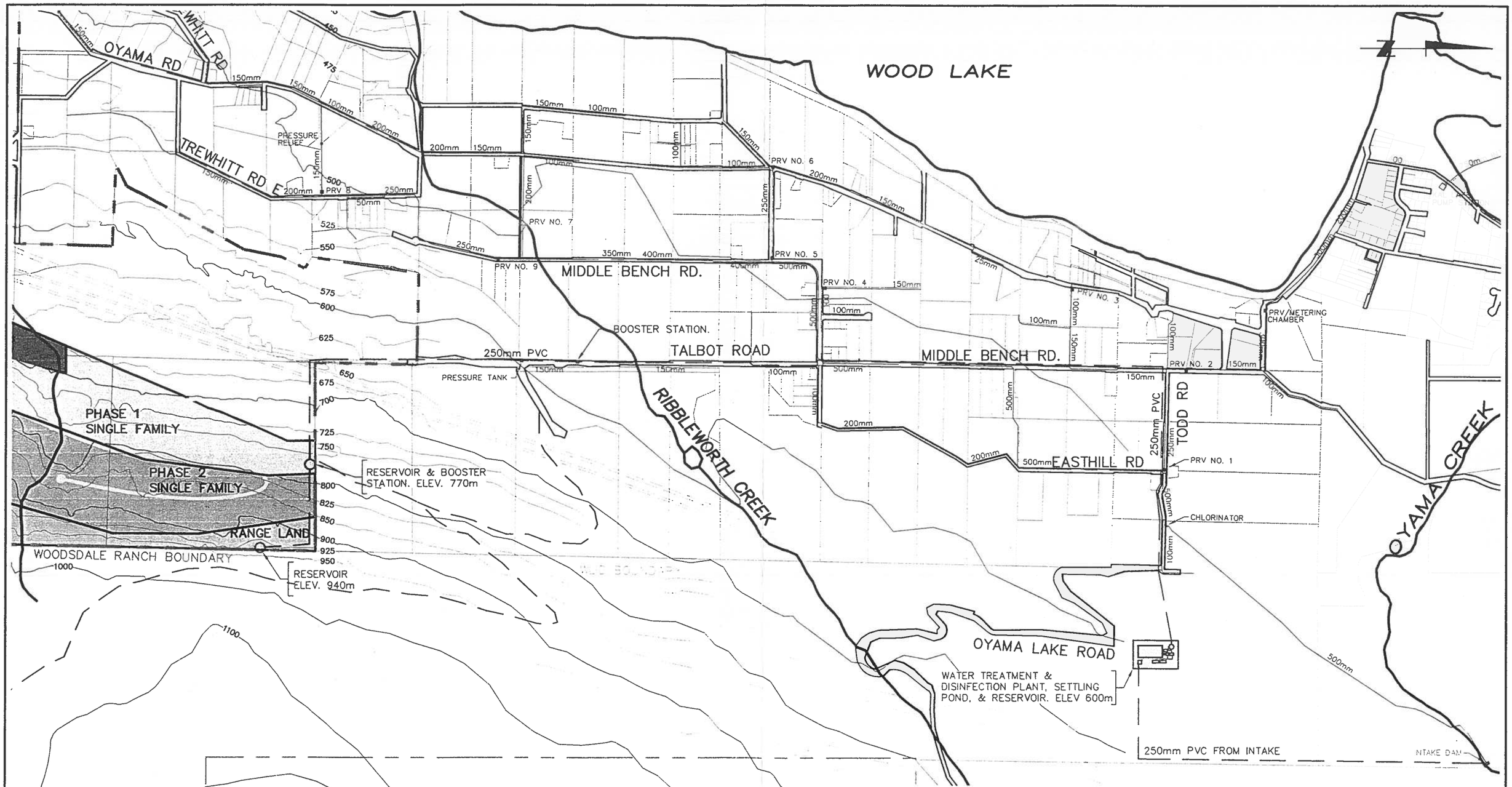
The most cost effective method to provide water from Clark Creek to Woodsdale Ranch that meets or exceeds GCDWQ involves the construction of an outlet control structure on the south end of Oyama Lake, creek channel improvements, a settling/balancing reservoir, screening facilities, a water treatment plant and finished water reservoir. As this is a gravity supply, the only other major works aside from pipelines and pressure reducing valves would be a lower balancing reservoir to reduce the size of mains required for fire flows.

Estimated Capital Cost	***$ 7,300,000***
Estimated Annual Operating Cost	***$ 190,000***

.2 Oyama Lake without Treatment

If a pipeline were constructed from Oyama Lake to the upper Woodsdale Ranch domestic reservoir, water quality would be better than untreated Clark Creek water but still susceptible to seasonal colour and turbidity fluctuations. Taking water directly from the lake may reduce the need for treatment and would provide the opportunity for hydroelectric power generation. Capital costs of a hydroelectric generation project have not been considered in the following estimate.

Estimated Capital Cost	***$5,000,000***
Estimated Annual Operating Cost	***$ 62,000***



Mould Engineering	DRAWN R.J.	DISTRICT OF LAKE COUNTRY	
	DESIGN J.G.	WOODSDALE RANCH WATER SUPPLY FROM WOOD LAKE IRRIGATION DISTRICT OPTION 4	DLC–WR4
	APPROVED		
	DATE JAN. 2004		
	SCALE 1:15,000		

5.5 Option 4 - Wood Lake Water System (Oyama Creek) Supply

.1 With Treatment (WLWS)

The Wood Lake Water System is the closest distribution system to the proposed Woodsdale Ranch development and draws its water from Oyama Creek. The principal storage reservoir for the WLWS is Oyama Lake, which does not have adequate surplus licenses to supply both domestic and irrigation requirements of Woodsdale Ranch, as is the case with the Clark Creek option.

Water quality within WLWS does not meet drinking water standards for colour and turbidity throughout the year; therefore, it will require treatment to meet GCDWQ standards year-round.

Extensive capital works are required to supply the Woodsdale Ranch development from the WLWS system with water that meets or exceeds GCDWQ. The booster station and reservoir proposed in the 1998 Capital Works Plan (CWP) in addition to a water treatment plant and finished water reservoir at the same site are required. A parallel mainline to the existing one must be constructed from the finished water reservoir, along Talbot Road, to the Woodsdale Ranch site. On the Woodsdale Ranch site, three booster stations, one pump-balancing reservoir and two domestic service reservoirs will be required. One significant benefit to this project is that it would provide a treated domestic water mainline that could provide the supply for a domestic water only distribution system for WLWS.

Estimated Capital Cost	***$ 8,400,000***
Estimated Annual Operating Cost	***$ 240,000***

.2 *Oyama Creek without Treatment*

If the existing water quality were deemed acceptable without treatment, the costs applicable to supply the Woodsdale Ranch development from WLWS are as follows:

Estimated Capital Cost (no treatment)	***$ 5,200,000***
Estimated Annual Operating Cost (no treatment)	***$ 130,000***

6. IRRIGATION WATER SUPPLY OPTIONS

As mentioned earlier, the Woodsdale Ranch developer has proposed to supply irrigation water to the development from a privately owned well(s). Although no license is required for groundwater use, it may not be in the best interest of the District to allow long term use of this well for irrigation water supply unless potential interference with local hydrogeology and licenses can be ruled out. Pending a thorough environmental assessment, it is recommended that a surface water supply be provided for irrigation water as discussed in Section 6.

Chemical analyses showed that the well meets irrigation water standards but exceeds the Guideline for Canadian Drinking Water Quality (GCDWQ) aesthetic objective of ≤ 0.05 mg/L manganese. Unless a hydrogeological study confirms otherwise, it is reasonable to assume that long-term withdrawals from this well at the volumes proposed will interfere with the hydrology of the Kalamalka-Wood Lake basin, which is very near its licensed capacity. Thus, the terms of reference for this study have been expanded to include review of alternate sources of irrigation water for the golf course and agricultural portions of the Woodsdale Ranch development.

Although the District's license on Okanagan Lake is largely unused at present, pumping water to Woodsdale Ranch would involve high long-term energy and operating costs. Both Clark Creek and Wood Lake Water System draw from Oyama Lake, and due to license limitations, it is not feasible to supply irrigation water from this reservoir, as the amount of license that remains to sustain future growth in WLWS would be more than exhausted by the full Woodsdale Ranch demands. Thus, Vernon Creek is the only viable source of surface water for irrigation of Woodsdale Ranch with respect to hydraulics and water availability. If the full domestic and agricultural components of the Woodsdale Ranch development were supplied from Vernon Creek, DCC funds collected should go towards transferring demand from Vernon Creek to the Okanagan Lake system prior to build-out of Woodsdale Ranch.

The transfer would occur by constructing a pipeline to deliver from the Okanagan Lake system to the Town Centre/Woodsdale area, and by constructing a pump station near Glenmore Road to pump into the Vernon Creek mainline. The DCC Program will be amended to provide for these facilities. The DCC revenues at the existing rate will be adequate to fund the required works.

To supply Woodsdale Ranch with irrigation water, a 350 mm pipeline must be constructed that would tie into the existing main below the intake. Water would be gravity supplied to storage ponds on the golf course. The supply of irrigation water from Vernon Creek to Woodsdale Ranch has some important benefits to the District. The District will be getting enough DCC revenue from Woodsdale Ranch to install the works needed to deliver at least 1280 da m^3 to the Vernon Creek system from the Okanagan Lake system. The supply can be accomplished by installing a booster pump station near Glenmore Road and pumping water from the Okanagan Lake system (HGL 536) to the Vernon Creek system (HGL 620). The pumping station requires a balancing reservoir located along the mainline at Elev. 620. Both the pump station and Vernon Creek will supply water into this reservoir.

Supplying irrigation water to Woodsdale Ranch will enable a power generation facility to be installed. The agricultural lands and golf courses are at a low enough elevation that water can be supplied from the WTP site by gravity. A power generator installed at the WTP can use both irrigation and domestic flows to generate power, which will reduce power costs for pumping domestic water. The cost of the generator is included in the Capital Cost Estimate, and the power generation is shown as a credit in operating costs.

Estimated Capital Cost	***$ 2,400,000***
Estimated Annual Operating Cost	***$ 39,000***

7. CAPITAL COST ESTIMATES

Estimates of the Capital Costs of supplying the Woodsdale Ranch Development are summarized in the following. The costs are subdivided into two categories: those costs which are the sole responsibility of Woodsdale Ranch, and those which are the responsibility of the District under the DCC Program.

The DCC program will be funded by all developers on a municipal-wide basis. The cost estimates are at a Class E level as defined by the DCC Best Practices Guide.

.1. *Woodsdale Ranch Direct Costs*

The costs which are solely the responsibility of Woodsdale Ranch are as follows:

.1	Okanagan Lake – Option 1	$ 5.75 Million
.2	Vernon Creek,with full treatment – Option 2	8.0 Million
.3	Vernon Creek, with no treatment – Option 2a	4.95 Million
.4	Clark Creek, with full treatment – Option 3	7.3 Million
.5	Oyama Lake, with no treatment – Option 3a	5.0 Million
.6	Oyama Creek, with full treatment – Option 4	8.4 Million
.7	Oyama Creek, with no treatment – Option 4a	5.2 Million

.2. *DCC Program*

The DCC program provides the mechanism to distribute costs of major water supply and distribution system components in an equitable and orderly manner. The DCC Best Practices Guide lists the following items as part of a DCC Program:

- water distribution modeling;
- water rights-of-way and easement acquisition;

- trunk or grid watermains;
- facility oversizing;
- booster pump stations;
- reservoirs;
- water treatment facilities

Similar to storm drainage and sanitary sewer, facility oversizing is the difference between the local and trunk requirements. Where a large diameter grid watermain fronts a land development project, and the same watermain also provides local service, the oversizing component may be included in a water DCC program. It is assumed that the cost of providing the local servicing need is paid by the developer of the land.

Each of the six Woodsdale options has a different DCC Program requirement. To provide details of the Program requirements for each of the six options would add considerable complexity to this report. However, sufficient work has been completed to determine that the existing DCC rates should be adequate to fund the DCC Program for any Option.

Details of the DCC Program are contained in the draft Master Water Servicing Plan. The current DCC rates for residential and agricultural development are as follows.

Table 3

DCC Rates

1.	Single Family Residential on Dry Land	$ 3,200	per unit
2.	Single Family Residential on Irrigated Land	1,200	per unit
3.	Multi Family Residential on Dry Land	2,200	per unit
4.	Multi Family Residential on Irrigated Land	1,200	per unit
5.	Irrigation of Dry Land	$ 10,000	per hectare

8. ANNUAL OPERATING COST ESTIMATES

An important consideration in supplying water to the Woodsdale Ranch development is the annual cost of operating and maintaining the facilities needed to treat and deliver water to the site. The elevation of the residential component of Woodsdale is considerably higher than the highest existing serviced land, so pumping will be necessary. The cost of pumping includes energy costs as well as operating and maintenance. The annual costs also include pumping an equivalent amount of water from Okanagan Lake to the Town Centre, Okanagan Centre, etc., as well as pumping (where necessary) to Woodsdale.

The annual costs only include those costs which are over and above the expense of supplying existing residential users.

.1	Okanagan Lake – Option 1	$ 200,000
.2	Vernon Creek,with full treatment – Option 2	240,000
.3	Vernon Creek, with no treatment – Option 2a	125,000
.4	Clark Creek, with full treatment – Option 3	190,000
.5	Oyama Lake, with no treatment – Option 3a	62,000
.6	Oyama Creek, with full treatment – Option 4	240,000
.7	Oyama Creek, with no treatment – Option 4a	130,000

9. CONCLUSIONS AND RECOMMENDATIONS

1. The District has enough surplus water supply capacity to supply the irrigation and domestic requirements of Woodsdale Ranch as well as other potential developments in the district. The bulk of the surplus capacity is in the Okanagan Lake Pump System.

2. The Okanagan Lake Pump System has surplus 'design' capacity, but major upgrading of the facility is necessary to achieve actual increased pumping rates. The improvements include replacement of electrical and mechanical equipment, improving safety equipment, and increasing the size of the balancing reservoir. The improvements to the Okanagan Lake System are require d for other developers as well as Woodsdale Ranch, so the costs of the improvements will be included in the DCC Program.

3. The Woodsdale Ranch development is located between elevation 500 m and 900 m. The existing water systems can supply to approximately elevation 570 m, so significant quantities of water will have to be pumped.

4. Six options for supplying water to Woodsdale were investigated. The Capital Costs of the options range from $4.95 million to $8.4 million. Annual Operating Costs range from $62,000 to $240,000. A factor in both the Capital and Operating Costs of the options is water treatment. The lower cost Options are based on no water treatment, which the District will have to consider. The Options will need to be discussed with both the Developer and the District before a selection is made.

5. Although not part of the Terms of Reference, preliminary designs and cost estimates were prepared for the facilities needed to supply the irrigation requirements of Woodsdale Ranch. The supply of irrigation water has an important benefit to the District in that power generation facilities can be incorporated into the project which will reduce pumping costs. The Capital Cost of supplying irrigation water is estimated to be $2.4 million. The Net Revenue (or offset power cost) is estimated to be $11,000

6. The District's DCC Program should be revised once an Option has been selected.

ANNEX 1

TERMS OF REFERENCE

ANNEX 1

TERMS OF REFERENCE

The following includes minor revisions to the June 10, 2003 terms of reference memorandum for David Gibson of Bel-MK Engineering addressed to District of Lake Country/New Town Planning.

DOMESTIC WATER SUPPLY STUDY

1. Identify domestic water supply options

2. Review the alternatives and assess the probability for implementation in either the short term or long term.

3. For any alternative deemed to have short-term potential:
   a. Determine the off-site works required to achieve connection to an existing water supply
   b. Determine the major on-site works required to supply water to the Woodsdale Ranch project and how they fit with the long-term plan
   c. Determine preliminary construction cost estimates for the off-site and major on-site works (i.e. on-site pump stations and reservoirs)

4. Determine operations and maintenance costs for the Woodsdale Ranch domestic water supply system over the next 25 years.

5. Analyze the effects of the demands created by Woodsdale Ranch on the existing water infrastructure. Determine the need for other off-site water system improvements (i.e. improvements to the existing distribution system that may be necessary).

6. If other off-site water system improvements are necessary, determine when they may need to be implemented. (i.e. phasing of items identified in item #5).

7. Compare operating and maintenance costs for the water system required to supply Pollard's Pond versus the Woodsdale Ranch project, and determine if the existing rate structure is suitable.

8. Determine the impact that the Woodsdale Ranch domestic supply requirements may have on the existing water licences.

9. Review the results of the analysis in meetings with the District and Woodsdale Ranch representatives. The number of meetings will be determined by mutual consent as the study is being conducted, likely two or three meetings.

10. Prepare the study in a format that will allow easy addition to the draft Master Water Servicing Plan.

11. Prepare a Draft Report within three (3) months of receiving notice to proceed.

12. Prepare a Final Report within one (1) month of receiving comments on the draft report.

ANNEX 2

DOMESTIC WATER SUPPLY OPTIONS
COST ESTIMATES

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 1 - OKANAGAN LAKE PUMPED SUPPLY
CAPITAL COST ESTIMATE

Item	Description	Unit		Unit Cost	Quantity		Amount
1.	**Pipelines**						
.1	300 mm DI (2000 m X $180/m)	m	$	180.00	2000	$	360,000
.2	300 mm DI (1700 m X $250)	m	$	250.00	1700		430,000
.3	250 mm DI (600 m X $150/m)	m	$	150.00	600		90,000
.4	Valves, Fittings & Paving	L.S.					80,000
					Pipeline Total	**$**	**960,000**
2.	**Reservoirs**						
.1	0.7 ML @ 525 m HGL	L.S.				$	300,000
.2	0.7 ML @ 650 m HGL	L.S.					300,000
.3	2.1 ML @ 770 m HGL	L.S.					450,000
.4	1.3 ML @ 940 m HGL	L.S.					400,000
					Reservoirs Total	**$**	**1,450,000**
3.	**Pump Station #1 (3 X 100 Hp)**						
.1	Building	m^2	$	800.00	65	$	50,000
.2	Power	L.S.					30,000
.3	100 Hp pump c/w VFD		$	45,000.00	3		135,000
.4	Electrical	L.S.					150,000
.5	Mechanical	L.S.					125,000
.6	Telemetry	L.S.					25,000
.7	Rechlorination equipment	L.S.					30,000
.8	Site preparation and landscaping	L.S.					25,000
					Total	**$**	**570,000**
4.	**Pump Station #2 (3 X 100 Hp)**						
.1	Building	m^2	$	800.00	60	$	50,000
.2	Power	L.S.					30,000
.3	100 Hp pump c/w VFD		$	45,000.00	3		135,000
.4	Electrical	L.S.					150,000
.5	Mechanical	L.S.					125,000
.6	Telemetry	L.S.					25,000
.7	Site preparation and landscaping	L.S.					25,000
					Total	**$**	**540,000**

5. Pump Station #3 (3 X 75 Hp)						
.1	Building	m^2	$ 800.00	60	$	50,000
.2	Power	L.S.				30,000
.3	75 Hp pump c/w VFD		$ 35,000.00	3		105,000
.4	Electrical	L.S.				130,000
.5	Mechanical	L.S.				115,000
.6	Telemetry	L.S.				25,000
.7	Site preparation and landscaping	L.S.				25,000
				Total	$	480,000
5. ***Subtotal***					***$***	***4,000,000***
6. Engineering & Contingencies @ 25 %						**1,000,000**
7. Project Management & Administration @ 15%						**750,000**
8. ***Total***					***$***	***5,750,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 1 - OKANAGAN LAKE PUMPED SUPPLY
ANNUAL OPERATING COST ESTIMATE

Item	Description		Amount
1.	**Pipelines, Reservoirs @ 1%**	**$**	**34,000**
2.	**Pump Stations @ 2.5%**	**$**	**57,000**
3.	**Power**	**$**	**109,000**
4.	***Total***	***$***	***200,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 2 - VERNON CREEK SUPPLY WITH FULL TREATMENT
CAPITAL COST ESTIMATE

Item	Description	Unit	Unit Cost	Quantity		Amount
1.	**Pipelines**					
.1	Connection to Mainline	L.S.			$	20,000
.2	Energy Disspiator	L.S.				180,000
.3	300 mm DI ($180 /m X 4400 m)	m	$ 180.00	4400		792,000
.4	250 mm DI ($150 /m X 600 m)	m	$ 150.00	625		90,000
.5	Valves & Fittings	L.S.				68,000
				Pipelines Total	**$**	**1,150,000**
2.	**Reservoirs**					
.1	1 ML @ WTP ~ 620 m	L.S.			$	350,000
.2	2.1 ML @ 770 m	L.S.				450,000
.3	1.3 ML @ 940 m	L.S.				400,000
				Reservoirs Total	**$**	**1,200,000**
3.	**Pump Station #1 (3 X 100 Hp)**					
.1	Building	m^2	$ 800.00	65	$	50,000
.2	Power	L.S.				30,000
.3	100 Hp pump c/w VFD		$ 45,000.00	3		135,000
.4	Electrical	L.S.				150,000
.5	Mechanical	L.S.				125,000
.6	Telemetry	L.S.				25,000
.7	Rechlorination equipment	L.S.				30,000
.8	Site preparation and landscaping	L.S.				25,000
				Total	**$**	**570,000**

4. Pump Station #2 (3 X 75 Hp)						
.1	Building	m^2	$ 800.00	60	$	50,000
.2	Power	L.S.				30,000
.3	75 Hp pump c/w VFD		$ 35,000.00	3		105,000
.4	Electrical	L.S.				130,000
.5	Mechanical	L.S.				115,000
.6	Telemetry	L.S.				25,000
.7	Site preparation and landscaping	L.S.				25,000
				Total	$	480,000
5. Water Treatment Plant		L.S.			**$**	**2,200,000**
6. *Subtotal*					***$***	***5,600,000***
7. Engineering & Contingencies @ 25%						**1,400,000**
8. Project Management & Administration @ 15%						**1,000,000**
9. *Total*					***$***	***8,000,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 2 - VERNON CREEK WITH FULL TREATMENT
ANNUAL OPERATING COST

Item	Description		Amount
1.	Pipelines, Reservoirs @ 1%	$	34,000
2.	Pump Stations @ 2.5%	$	37,000
3.	Power (Woodsdale Supply)	$	54,000
4.	Power (Okanagan Lake Supplement, 1:10 years)	$	5,000
5.	Water Treatment Plant	$	110,000
	Total	$	240,000

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 2a - VERNON CREEK SUPPLY WITH NO TREATMENT
CAPITAL COST ESTIMATE

Item	Description	Unit	Unit Cost	Quantity		Amount
1.	**Pipelines**					
.1	Connection to Mainline	L.S.			$	20,000
.2	Emergy Dissipator	L.S.				180,000
.3	300 mm DI Pipe	m	$ 180.00	4400		792,000
.4	250 mm DI Pipe	m	$ 150.00	625		90,000
.5	Valves & Fittings	L.S.				68,000
				Pipelines Total	**$**	**1,150,000**
2.	**Reservoirs**					
.1	1 ML @ WTP ~ 620 m	L.S.			$	350,000
.2	2.1 ML @ 770 m	L.S.				450,000
.3	1.3 ML @ 940 m	L.S.				400,000
				Reservoirs Total	**$**	**1,200,000**
3.	**Pump Stations**					
	Station #1 (3 X 100 Hp)					
.1	Building	m^2	$ 800.00	65	$	50,000
.2	Power	L.S.				30,000
.3	100 Hp pump c/w VFD		$ 45,000.00	3		135,000
.4	Electrical	L.S.				150,000
.5	Mechanical	L.S.				125,000
.6	Telemetry	L.S.				25,000
.7	Rechlorination equipment	L.S.				30,000
.8	Site preparation and landscaping	L.S.				25,000
				Sub Total	**$**	**570,000**

Station #2 (3 X 75 Hp)						
.1	Building	m^2	$ 800.00	60	$	50,000
.2	Power	L.S.				30,000
.3	75 Hp pump c/w VFD		$ 35,000.00	3		105,000
.4	Electrical	L.S.				130,000
.5	Mechanical	L.S.				115,000
.6	Telemetry	L.S.				25,000
.7	Site preparation and landscaping	L.S.				25,000
				Sub Total	$	480,000
				Pump Stations Total	**$**	**1,050,000**
4. Subtotal					**$**	**3,400,000**
5. Engineering & Contingencies @ 25 %						900,000
6. Project Management & Administration @ 15%						650,000
7. ***Total***					***$***	***4,950,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 2a - VERNON CREEK WITH NO TREATMENT
ANNUAL OPERATING COST ESTIMATE

Item	Description		Amount
1.	**Pipelines, Reservoirs @ 1%**	**$**	**30,000**
2.	**Pump Stations @ 2.5%**	**$**	**36,000**
3.	**Power (Woodsdale Supply)**	**$**	**54,000**
4.	**Power (Okanagan Lake Supplement, 1:10 years)**	**$**	**5,000**
5.	***Total***	***$***	***125,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 3 - CLARK CREEK WITH TREATMENT
CAPITAL COST ESTIMATE

Item	Description	Unit	Unit Cost	Quantity		Amount
1.	**Pipelines**					
.1	300 mm PVC or DI	m	$ 180.00	2500	$	450,000
.2	Valves & Fittings	L.S.				50,000
				Mains Total	**$**	**500,000**
2:	**Reservoirs**					
.1	2,100,000 @ 940 m	L.S.			$	450,000
.2	1,300,000 L @ 770 m	L.S.				400,000
				Reservoirs Total	**$**	**850,000**
3.	**Clark Creek Development**					
.1	Oyama Lake control structure	L.S.			$	450,000
.2	Creek Channel Stabilization	L.S.				200,000
.3	Balancing storage, intake, screening facilities	L.S.				400,000
.4	Road & Power Extension	L.S.				500,000
				Clark Creek Development Total	**$**	**1,550,000**
4.	**Water Treatment Plant**	L.S.			**$**	**2,200,000**
5.	**Subtotal**				**$**	**5,100,000**
6.	**Engineering & Contingencies @ 25 %**					**1,275,000**
7.	**Project Management & Administration @ 15 %**					**925,000**
8.	***Total***				***$***	***7,300,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 3 - CLARK CREEK WITH TREATMENT
ANNUAL OPERATING COST ESTIMATE

Item	Description		Amount
1.	Pipelines, Reservoirs	$	19,000
2.	Intake, Screening, Lake Control	$	56,000
3.	Water Treatment Plant Costs	$	115,000
4.	*Total*	*$*	*190,000*

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 3a - OYAMA LAKE WITH NO TREATMENT
CAPITAL COST ESTIMATE

Item	Description	Unit		Unit Cost	Quantity		Amount
1.	**Pipelines**						
.1	Road Construction	m	$	20.00	8600	$	172,000
.2	300 mm PVC	m	$	180.00	3000		540,000
.3	300 mm DI / Steel	m	$	180.00	5000		900,000
.4	250 mm DI	m	$	180.00	600		110,000
.5	Valves & Fittings	L.S.					48,000
					Pipelines Total	**$**	**1,770,000**
2.	**Reservoirs**						
.1	2,100,000 @ 940 m	L.S.				$	380,000
.2	Chlorination Station	L.S.					100,000
.3	1,300,000 L @ 770 m	L.S.					400,000
.4	Road & Power Extension	L.S.					500,000
					Reservoirs Total	**$**	**1,380,000**
3.	**Oyama Lake Outlet**	**L.S.**				**$**	**350,000**
4.	**Subtotal**					**$**	**3,500,000**
5.	**Engineering & Contingencies @ 25 %**						**850,000**
6.	**Project Management & Administration @ 15 %**						**650,000**
7.	***Total***					***$***	***5,000,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 3a - OYAMA LAKE WITH NO TREATMENT
ANNUAL OPERATING COST ESTIMATE

Item	Description		Amount
1.	Pipelines, Reservoirs @ 1%	$	45,000
2.	Outlet Control & Maintenance @ 2.5 %	$	12,500
3.	Power	$	4,500
4.	*Total*	*$*	*62,000*

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 4 - OYAMA CREEK WITH FULL TREATMENT
CAPITAL COST ESTIMATE

Item	Description		Amount
1.	**Mains**		
.1	300 mm PVC or DI (proposed reservoir site to Talbot Rd)	$	700,000
.2	300 mm DI (to first domestic reservoir)		54,000
.3	250 mm DI (to second domestic reservoir)		75,000
.4	Paving		16,000
.5	Valves & Fittings		155,000
	Mains Total	**$**	**1,000,000**
2.	**Reservoirs**		
.1	700,000 @ 600 m HGL	$	300,000
.2	2,100,000 L @ 770 m HGL		450,000
.3	1,300,000 L @ 940 m HGL		400,000
	Reservoirs Total	**$**	**1,150,000**
3.	**Pump Station #1 (3 X 150 Hp)**		
.1	Building	$	60,000
.2	Power		30,000
.3	150 Hp pump c/w VFD		150,000
.4	Rechlorination equipment		30,000
.5	Electrical		145,000
.6	Mechanical		125,000
.7	Telemetry		25,000
.8	Site preparation and landscaping		25,000
	Pump Station #1 Total	**$**	**590,000**
4.	**Pump Station #2 (3 X 100 Hp)**		
.1	Building	$	50,000
.2	Power		30,000
.3	100 Hp pump c/w VFD		135,000
.4	Electrical		150,000
.5	Mechanical		125,000
.6	Telemetry		25,000
.7	Site preparation and landscaping		25,000
	Pump Station # 2 Total	**$**	**540,000**

5. Oyama Creek Water Treatment Plant	$	2,200,000
6. Finished Water Reservoir (1 da m^3)	$	350,000
7. Subtotal	$	5,830,000
8. Engineering & Contingencies @ 25%		1,470,000
9. Project Management & Administration @ 15%		1,100,000
10. Total	*$*	*8,400,000*

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
OPTION 4 - OYAMA CREEK WITH FULL TREATMENT
ANNUAL OPERATING COST ESTIMATE

Item Description		Amount
1. Pipelines, Reservoirs @ 1%	$	31,000
2. Pump Stations @ 2.5 %	$	40,000
3. Power	$	60,000
4. Water Treatment Plant	$	110,000
5. Total	*$*	*240,000*

ANNEX 3

IRRIGATION WATER SUPPLY COST ESTIMATES

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
VERNON CREEK IRRIGATION SUPPLY
CAPITAL COST ESTIMATE

Item	Description	Unit	Unit Cost	Quantity	Amount
1.	**Pipelines**				
.1	Connection to Mainline	L.S.			$ 20,000
.2	350 mm DI ($180 /m X 4400 m)	m	$ 180.00	4400	792,000.00
.3	Valves & Fittings	L.S.			118,000.00
				Pipelines Total	**$ 930,000**
2.	**Power Generator**				
.1	Building, 100 m^2 @ $500	m^2	$ 100.00	500	$ 50,000
.2	Generators, 1 @ $100,000				$ 100,000
	1 @ $250,000				$ 250,000
.3	Mechanical				$ 100,000
.4	Electrical				$ 200,000
.5	Power Lines				$ 40,000
				Power Generator Total	**$ 740,000**
3.				**Subtotal**	**$ 1,670,000**
4.	**Engineering & Contingencies @ 25 %**				$ 420,000
5.	**District Administration @ 10 %**				$ 310,000
6.	***Total***				***$ 2,400,000***

DISTRICT OF LAKE COUNTRY - WOODSDALE RANCH
VERNON CREEK IRRIGATION SUPPLY
ANNUAL OPERATING COST

Item			
1. Pipelines, Reservoirs @ 1%		**$**	**13,000**
2. Power Generator @ 2.5%		**$**	**26,000**
3.	***Total***	***$***	***39,000***