VIA EMAIL

January 12, 2016 File: 1577.0065.01

District of Lake Country
10150 Bottom Wood Lake Road
Lake Country, BC, V4V 2M1

VIA EMAIL:

Attention: Greg Buchholz – Director of Infrastructure Services

RE: Lakestone Servicing and Water Master Plan Integration

We are pleased to submit the FINAL copy of the Lakestone Servicing and Water Master Plan Integration Report. Thank you for the opportunity to work with the District on this project.

Sincerely,

URBAN SYSTEMS LTD.

Jeremy Clowes, P.Eng.
Water Resources Engineer

Steve Brubacher, P.Eng.
Senior Review

/jc
Enclosure

cc: Jason Barta, Project Manager

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1577.0065.01

LAKE COUNTRY

Life. The Okanagan Way.

Lakestone Servicing And Water Master Plan Integration

URBAN systems

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January 2016

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Appendices

1.0 Introduction

The Lakestone Development (Lakestone Master Plan, April 2012) was first approved by Council in May 2012. The application for this approval includes the Master Water Plan, August 2007 as prepared by Agua Consulting Inc. Key elements of the Council approval included the following commitments:

- All domestic water should originate from Okanagan Lake
- Interconnection of the Vernon Creek and Okanagan Lake Sources
- Dead-end water mains are to be minimized and, if possible, eliminated
- Pumping systems not supported with reservoir storage are to be avoided

In 2012, a revised Lakestone Master Plan was submitted and accepted by the District. This was prepared in response to several dramatic changes to the development, including the removal of the proposed golf course, vineyards and underground boat storage facility.

Also in 2012, the District adopted the District of Lake Country Water Master Plan (WMP) which outlines the broad community plan for providing water servicing.

The purpose for this report is to harmonize the servicing approach for Lakestone with the overall District servicing vision and strategy. The previous Lakestone Master Plans have been used for general reference but due to varying levels of service and design criteria an updated servicing concept has been developed based on the WMP.

2.0 Design Criteria

The key design criteria used to establish the preferred servicing option for Lakestone are summarized in this section. The key criteria includes a summary of system demands, estimated Lakestone demands and storage requirements.

The following table outlines the per capita water use rates currently outlined in the District's Subdivision and Development Bylaw, those used in the Water Master Plan, and those adopted by the District for this servicing review. The key point is that Subdivision and Development Bylaw values are generally conservative in nature and used for local distribution system design. While the Water Master Plan values consider the entire system as a whole with projections to 2030. The values for this servicing review are based on recent reviews by the District of current metered water use and incorporate a 10% factor of safety for climate variability. As such they are slightly more conservative in nature then the Water Master Plan but not as conservative as the Subdivision Bylaw.

Table 2.1 Residential Per Capita Demand

	Subdivision Bylaw	Water Master Plan	Lakestone Servicing Review
Average Day Demand	1,000 litres/day	690 litres/day	800 litres/day
Maximum Day Demand	3,000 litres/day	1,900 litres/day	2,400 litres/day

2.1 System Demands (excluding Lakestone)

Table 2.2 and 2.3 below list the estimated existing and future maximum day demands (MDD) for the Districts six major water systems, respectively, excluding the Lakestone Development. An allowance of 1,500 units (3,375 people) and a corresponding maximum day demand of 8.1 million litre per day (MLD) for the future McCoubrey Plateau development, located south of Lakestone, is included in **Table 2.3** under Swalwell Lake demands.

The WMP projects a total of 3,100 additional residential units by 2030 within the District so this leaves 1,600 units for Lakestone and other developments within the District. From a water demand perspective the WMP projects a total water need of 94 ML/day under maximum day demands in 2030 which includes a 13.2 ML/day for residential growth and a reduction of 20 ML/day associated with water use efficiency targets for existing customers. Without this water use efficiency being reached the total projected demand for the District is 114 ML/day.

Table 2.2 — Existing MDD (MLD)

Demand Type	Okanagan Lake	Swalwell Lake	Kalamalka Lake	Oyama	Alto	Raven Ridge	Total
Domestic & Agricultural	13.3	24.8	9.4	22.8	4.4	0.9	75.6
Domestic Indoor/Outdoor	10.8	16.2	1.5	1.2	4.4	0.9	35.0

Table 2.3 – Future MDD (MLD)

Demand Type	Okanagan Lake	Swalwell Lake	Kalamalka Lake	Oyama	Alto	Raven Ridge	Total
Domestic & Agricultural	11.4	45.1	9.1	22.6	3.6	0.7	92.5
Domestic Indoor/Outdoor	8.9	21.5	1.2	1.0	3.6	0.7	36.9

2.2 Lakestone Demands

Table 2.4 below outlines the anticipated growth for Lakestone. A phasing plan along with equivalent populations were provided by the Lakestone developer's engineer (Ecora Engineering). The Lakestone phases that are split into upper and lower portions can be adjusted as required to suit final reservoir elevations and pressure zones.

Table 2.4 – Future Lakestone MDD

Location	No. of Units	Equivalent Population	MDD (L/min)
Lakestone Phase 1	20	60	100
Lakestone Phase 2	119	295	491.67
Lakestone Phase 3 (Lower)	184	431	718.33
Lakestone Phase 3 (Upper)	41	82	136.67
Lakestone Phase 4	67	151	251.67
Lakestone Phase 5 (Lower)	104	282	470
Lakestone Phase 5 (Upper)	29	87	145
Lakestone Phase 6 (Lower)	117	351	585
Lakestone Phase 6 (Upper)	34	90	150
Lakestone Phase 7 (Lower)	108	324	540
Lakestone Phase 7 (Upper)	26	62	103.33
Lakestone Phase 8 (Lower)	132	306	510
Lakestone Phase 8 (Upper)	119	267	445
Lakestone Floating Phase	265	530	883.33
Total	**1,365**	**3,318**	**5,530 L/min**
			8.0 MLD
			92 L/s

This projected maximum day demand for Lakestone when combined with the McCoubrey Plateau development equals 16 ML/day which slightly exceeds the 13.2 ML/day total growth forecast in the Water Master Plan. This is associated with the higher per capita water used assumed in this analysis.

Storage Requirements

Sizing for treated storage as outlined in the Subdivision Development Bylaw follows the sizing calculation S = A + B + C, where:

- A = balancing storage (25% of system of non-agricultural MDD);
- B = fire flow storage (per District fire flow values and FUS guidelines for supply duration)
- C = emergency storage (25% of A plus B)

Balancing storage is only provided for non-agricultural demands, since agricultural demands are relatively consistent during the irrigation season. This is consistent with the methodology used in the WMP.
The District has reviewed the reliability of its water supply and the number of interconnections between the two systems (Okanagan Lake and Swalwell Lake) and determined that it is unnecessary to provide

emergency storage in the system reservoirs, supplied by these two sources, thereby eliminating part C in the above formula.

Table 2.5 summarizes the projected storage volumes as outlined in the WMP with the inclusion of emergency storage.

Table 2.5 – WMP Minimum Required

	2012	2030
Balancing Storage (25% of non-agricultural MDD)	3,800 m^3	9,000 m^3
Fire Storage		
15,000 L/min x 3.25 hours x 1 reservoir (Eldorado WTP Site)	2,925 m^3	2,925 m^3
13,500 L/min x 2.9 hours x 2 reservoirs (Lower Lakes, Lakestone 600m)	4,698 m^3	4,698 m^3
3,600 L/min x 1.4 hours x 3 reservoirs (Upper Lakes, Upper Lakestone 655m, Okanagan Lake)	907 m^3	907 m^3
Emergency Storage (25% of Balancing + Fire)	3,100 m^3	4,180 m^3
Total	**15,430 m^3**	**21,910 m^3**

Table 2.6 below identifies the revised storage requirements based on eliminating emergency storage and the preferred Lakestone servicing concept (outlined in Section 3.0) which relies on one onsite reservoir only (versus the two that were originally planned when the WMP was issued).

Table 2.6 – Revised Future Minimum Required Storage

	2030
Balancing Storage for Existing (25% of non-agricultural MDD)	7,209 m^3
Balancing Storage for Lakestone	1,991 m^3
Balancing Storage for McCoubrey	2,025 m^3
Fire Storage	
15,000 L/min x 3.25 hours x 1 reservoir (Eldorado WTP site)	2,925 m^3
13,500 L/min x 2.9 hours x 1 reservoirs (Lower Lakes)	2,350 m^3
12,000 L/min x 2.5 hours x 1 reservoirs (Lakestone 655m)	1,800 m^3
3,600 L/min x 1.4 hours x 2 reservoirs (OK Lake/Upper Lakes)	600 m^3
Total	**18,900 m^3**

Based on the storage volumes provided above, **Table 2.7** identifies the future required storage volumes for the Swalwell and Okanagan Lake sources.

Table 2.7 – Minimum Reservoir Storage Requirements

	Existing Capacity (m^3)	Additional Capacity Required for Existing (m^3)	Additional Capacity Required for Lakestone (m^3)	Total Required Volume (m^3)
Eldorado	0 (treated)	6,975[1]	1,264[2]	8,239[3]
Lower Lakes	4,000	0	0	0
Upper Lakes	1,500	0	0	0
Okanagan Lake	2,270	n/a	0	2,270
Lakestone 655 m Reservoir	n/a	n/a	2,315[4]	2,315
Total	7,770	4,050	3,579	9,899

Notes:

1. Based on existing Swalwell MDD of 16.2 MLD per Table 2.2 + a fire flow allowance of 2,925 m^3.
2. Based on Lakestone Phase 3, Phase 4, Lower Phase 5, Lower Phase 7, Lower Phase 8 and Floating Phase MDD of 3,510 L/min.
3. Cost estimate allows for 6,000 m^3 reservoir. Eldorado reservoir will have to be expanded in the future to accommodate Oyama, Alto, Raven Ridge and McCoubrey. Based on values in Table 2.3, future expansion of up to 4,875 m^3 of storage at Eldorado will be required (total required storage volume equals 10,875 m^3). The low lift station will be built with surplus capacity to provide the District with some flexibility for meeting existing demands and the required timing for the reservoir expansion.
4. Based on Lakestone Upper Phase 5, Phase 6, Upper Phase 7 and Upper Phase 8 MDD of 1,428 L/min.

3.0 Servicing Options

Three servicing options were considered for Lakestone. The primary variables were the source of water supply, number of onsite reservoirs and number of onsite pump stations. The three servicing options that were considered are summarized in **Table 3.1**.

Table 3.1 – Lakestone Servicing Options

	Option 1	Option 2	Option 3
Primary Source	Okanagan Lake	Swalwell Lake	Swalwell Lake
Backup Source	Swalwell Lake	Okanagan Lake	Okanagan Lake
Number of Onsite Reservoirs	2	1	1
Number of Onsite Pump Stations	3	2	3
Number of Proposed Interconnections Between Primary and Backup Source	2	2	2
Other Major System Upgrades Required	Okanagan Reservoir upgrade including adding UV disinfection, dedicated outlet and storage expansion Jim Bailey pump station replacement Eldorado low lift pump station and treated water storage	Same as Option 1 with two exceptions: 1. Okanagan Lake Reservoir expansion not required 2. Additional treated storage required at Eldorado site.	Same as Option 1 with two exceptions: 1. Okanagan Lake Reservoir expansion not required 2. Additional treated storage required at Eldorado site.

The District selected Option 2 as the preferred servicing plan after reviewing life cycle costs, operation and maintenance requirements, reliability of supply and flexibility for developing Lakestone.

Option 2 will allow for Lakestone Phases 3, 4, Lower 5, Lower 7, Lower 8 and the Floating Phase to be fed by gravity from the Eldorado site (Swalwell Lake). Lower Phase 6 and Upper Phase 5, 7 and 8 will be supplied from a proposed reservoir at Lakestone with full water level of 655 m. Upper Phase 6 will be supplied by a booster station. During periods of high turbidity or any other interruption in supply from Swalwell Lake, Lakestone will be supplied with water from Okanagan Lake.

The water supply upgrades in Option 2 are sequenced to allow the development of Lakestone to proceed in the following order:

- Water Stage Upgrades 2, 3 and 4 – Lakestone Phases 4 and Lower 5 can proceed
- Water Stage Upgrade 5 – Lakestone Lower Phase 7 can proceed
- Water Stage Upgrade 6 – Lakestone Lower Phase 8 can proceed
- Water Stage Upgrade 7 – Lakestone Upper Phase 5, Lower Phase 6, Upper Phase 7, Upper Phase 8 can proceed
- Water Stage Upgrade 8 – Lakestone Upper Phase 6 can proceed
- Water Stage Upgrade 9 – Lakestone Floating Phase can proceed

Refer to the figure in **Appendix A** which identifies the preferred servicing concept. The preferred servicing concept aligns with the WMP objectives and takes a proactive risk management approach to address the major sources of risk exposure including:

- Climate Change – 10% capacity built in for climate change resilience.
- Infrastructure Failure – Source and distribution redundancy improved with interconnections and in-system storage to be increased.
- Changes to Growth and Development – Phasing plan designed to provide flexibility and not overbuild infrastructure until works are needed.

4.0 Water License Review

The table below provides a summary of available supply for Swalwell Lake and Okanagan Lake as identified in the WMP. Note that the last hydrological study for Swalwell Lake was completed in 1977. It is recommended that an updated study be completed to verify the watershed yield as per the WMP.

Table 4.1 – Water License Annual Flow Summary and Max Day Withdrawal Limits

	Swalwell Lake	Okanagan Lake
Existing Water License		
a. Irrigation	7,459 ML	0 ML
b. Water Works	1,204 ML	10,997 ML
c. Total	8,663 ML	10,997 ML
Water Availability		
a. Watershed Yield	9,868 ML	10,997 ML
b. Fish Flows	-1,750 ML	0 ML
c. Est. Operational Waste	-617 ML	0 ML
d. Total	7,501 ML	10,997 ML
Max Day Withdrawal Limit	4.8 ML/d	32 ML/d

The WMP identifies a system-wide future (2030) demand of 11,700 ML/yr based on achieving a 25% reduction in existing demands and adding a 10% safety factor for climate change. The WMP future demand value includes an allowance for an additional 3,100 units and a corresponding annual demand of 1,600 ML/year. The projected annual demand of Lakestone and McCoubrey is 1,960 ML/year which is a 3% increase over the WMP.

The following table summarizes the total waterworks license capacity and projected demands for each source. The existing Water Works volumes are based on 46% (average annual) and 35% (maximum day) of total 2010 water use as outlined in the Water Master Plan. These values should be reviewed on a source by source basis. These values have also been reduced by 25% to reflect the District's water

conservation targets. Please note that these license volumes do not reflect abandoning any of the current District water sources for the remaining portions of the District.

Table 4.2 – Water Use Summary by Source (Annual)

	Swalwell Lake	Okanagan Lake
Annual Volume		
Waterworks License	1,204 ML/year	10,997 ML/year
a. Existing Waterworks less 25%	1,100 ML/year (46% of current ADD less 25%)	588 ML/year (46% of current ADD less 25%)
b. Lakestone	970 ML/year	
c. McCoubrey	990 ML/year	
Total 2030 Demand	3,060 ML/year	588 ML/year
Additional Waterworks License Required	1,856 ML/year	10,409 ML/year surplus

Table 4.3 – Water Use Summary By Source (Maximum Day)

	Swalwell Lake	Okanagan Lake
Peak Withdrawal		
Waterworks License	4.8 ML/day	32 ML/day
a. 2010 Waterworks less 25%	8.7 ML/day (35% of current MDD less 25%)	4.7 ML/day (35% of current MDD less 25%)
b. Lakestone	8.0 ML/day	0
c. McCoubrey	8.1 ML/day	0
Total 2030 Demand	24.8 ML/day	4.7 ML/day
Additional Waterworks License Required	20 ML/day	27.3 ML/day Surplus

Swalwell Lake License Review

It is recommended, as per the WMP, that the District review the current water use split between agriculture and other users in order to confirm the amount of additional annual and peak license capacity required. Based on this review the conversion of irrigation license capacity to waterworks license capacity can be completed as needed to suit future demands.

Okanagan Lake License Review

It is recommended that the District request an approval to increase the maximum day withdrawal limit to 40 MLD to align with lake pump station's capacity. Even though additional capacity is not anticipated to be required it will ensure that pump operation does not exceed license capacity.

5.0 Proposed Servicing Concept

The preferred servicing concept has been broken down into 9 major stages as identified in **Appendix A**. A summary of each stage is provided in this section. Refer to **Appendix B** for a schematic overview of the servicing concept.

1. Lower Phase 3 Water Supply
   As is apparent from the above title, the intent of Stage 1 is to provide water to the Lakestone's lower Phase 3. The work was constructed in 2105.

   1.1. Tyndall Road 350 mm Watermain Supply (Developer Project – Estimated Cost of $948,000)
   To meet the Stage 1 objective, a 350 mm watermain was installed along Tyndall Road from the Okanagan Center Road intersection to the phase 3 of Lakestone. Lower Phase 3 will be initially supplied by Okanagan Lake but can be converted over to the Swalwell Lake source after the Stage 4 upgrades are completed.

2. Establish Primary Water Supply and Backup Connection
   The two upgrades included in Stage 2 will establish the primary supply for Lakestone from the Eldorado site (Swalwell Lake source) and the backup supply from Okanagan Lake.

   2.1. Eldorado Low Lift Pump Station and Treated Storage (District Project – Estimated Cost of $5,695,000)

   The Eldorado Low Lift Pump Station will be constructed for the primary purpose of conveying water from an existing 30,000 m^3 earthen balancing reservoir to a treated water reservoir initially and ultimately to a future treatment facility. The low lift pump station will be sized to convey up to 750 L/s or 64.8 MLD. This design flow allows for the future MDD demands for Swalwell Lake, Alto, Lakestone, and McCoubrey. The estimated project cost assumes the station will utilize canned vertical turbines with 2 duty pumps, 1 standby pump and standby generator. The station will ultimately be sized to convey flows for Oyama and Raven Ridge as well and require a capacity of 926 L/s or 80 MLD.

   A 6,000 m^3 reservoir will be constructed with the low lift pump station. Currently all flows are conveyed from the earthen reservoir directly into the distribution system after being chlorinated. The treated water reservoir will provide storage of chlorinated water which will improve chlorine contact time and water quality. The reservoir will provide balancing and fire flow storage. The reservoir can be filled by gravity from Swalwell Lake (primary operation) or by pumping from Okanagan Lake via the Jim Bailey Pump Station (project 2.2 below). The reservoir will ultimately be expanded to 10,875 m^3.

   2.2. Glenmore Road Pump Station (District Project – Estimated Cost of $1,275,000)
   The purpose of the Glenmore Road Pump Station is to convey flows from Okanagan Lake to the Swalwell Lake distribution area during freshet when high turbidity from Swalwell Lake is experienced or if there is any interruption in supply from Swalwell Lake. The existing Jim Bailey

Pump Station is located at the intersection of Beaver Lake Road and Jim Bailey Road. The pump station is housed in a buried structure and has limited capacity. To improve safety conditions for operations staff and provide additional capacity, a replacement station is proposed. The replacement station will be equipped with two duty pumps that are each capable of delivering 100 L/s. The District prefers that the replacement station be relocated to a site in close proximity of the Glenmore Road PRV station. The District will have to purchase property for the replacement station which has not been included in the estimate.

3. Okanagan Lake Water Quality Improvements
   Three upgrades will be completed to improve water quality on the Okanagan Lake supply.

   3.1. Okanagan Lake Reservoir Dedicated Outlet (District Project – Estimated Cost of $592,000)
   The Okanagan reservoir currently utilizes a common inlet and outlet pipe. A dedicated outlet pipe will be installed and the existing pipe will become a dedicated fill line. The dedicated fill line will increase chlorine contact time.

   3.2. Okanagan Reservoir UV Treatment Facility (District Project – Estimated Cost of $2,565,000)
   The Okanagan reservoir will be upgraded to include a UV disinfection system which will be tied to the reservoir inlet pipe. The UV disinfection system will be sized to match the capacity of the lake pump station (up to 464 L/s provided license is updated as noted in Section 4.0).

   3.3. Stubbs Road Connection (District Project – Estimated Cost of $37,000)
   Stubbs Road is currently supplied directly from a watermain that will become a dedicated fill line for Okanagan reservoir. The Stubbs Road supply connection will be switched over to a nearby distribution main as part of an upgrade to create a dedicated fill line for the Okanagan reservoir.

4. Upper Phase 3, Phase 4 and Lower Phase 5 Water Supply
   Stage 4 works will establish water supply to LakestoneUpper Phase 3, Phase 4 and Lower Phase 5.

   4.1. Long Road Supply Main (Developer Project – Estimated Cost of $916,000)
   A new watermain will be installed along Long Road from the Camp Road intersection to Lakestone Phase 3 as shown in **Appendix A**. The existing watermain on Long Road will be abandoned. The watermain will provide the primary supply to upper Phase 3, phase 4 and lower phase 5.

   4.2. Phase 3 PRV (Developer Project – Estimated Cost of $260,000)
   A PRV will be constructed at the end of the distribution main from Long Road and connected to the Tyndall Road supply line. The PRV will provide redundancy in supply to lower Phase 3 which is serviced from Okanagan Lake.

5. Lower Phase 7 Water Supply
   Stage 5 works will establish water supply to Lakestone Phase 7.

   5.1. Phase 7 Distribution Main (Developer Project – Estimated Cost of $TBD)

A new watermain will be installed to service Lower Phase 7 as shown in **Appendix A**. The watermain will connect to an existing watermain on Chase Road that is supplied from the Eldorado site (Swalwell Lake).

6. Lower Phase 8 and Floating Phase Water Supply
   Stage 6 works will establish water supply to Lakestone Phase 8 and the floating phase.

   6.1. Lakestone South-East Supply Main_Chase Road (Developer Project – Estimated Cost of $414,000)
   A new watermain will be installed to service Lower Phase 8 and the floating phase as shown in **Appendix A**. The watermain will connect to an existing watermain on Chase Road that is supplied from the Eldorado site (Swalwell Lake).

   6.2. Lakestone South-East Supply Main_Okanagan Centre Road (Developer Project – Estimated Cost of $333,000)
   A new watermain will be installed along Okanagan Center Road to service Lower Phase 8 as shown in **Appendix A**. The watermain will connect to the above noted watermain (project 6.1).

   6.3. Connection to Lakestone South-East Supply Main (Developer Project – Estimated Cost of $21,000)
   A new watermain will be installed to service Lower Phase 8 as shown in **Appendix A**. The watermain will connect to a proposed watermain on Okanagan Center Road (project 6.2) that is supplied from the Eldorado site (Swalwell Lake).

7. Upper Phase 5, Lower Phase 6, Upper Phase 7, Upper Phase 8 Water Supply
   Stage 7 works will establish water supply to the Lakestone Upper Phase 5, Lower Phase 6, Upper Phase 7 and Upper Phase 8.

   7.1. Booster Station to 655 m Reservoir (Developer Project – Estimated Cost of $1,580,000)
   A booster station will be constructed for the primary purpose to convey water from Swalwell Lake via the Long Road supply main to a proposed reservoir with a full water level of 655 m. The station will also have pumps capable of conveying water from Okanagan Lake via the Tyndall Road supply main to the proposed 655 m reservoir in case of interruption in supply from Swalwell Lake. The estimated project cost assumes the station will be equipped with 4 pumps in total. There will be a duty pump and standby pump for both the Swalwell and Okanagan Lake sources. The Swalwell pumps will be horizontal split cases and the Okanagan pumps will be vertical turbine pumps with a wet well. The station will be equipped with a standby generator. The station will be sized to convey MDD and the design flow for each pump is 23 l/s.

   7.2. Dedicated Supply Main to 655 m Reservoir (Developer Project – Estimated Cost of $633,000)
   A dedicated reservoir supply main will be installed from the above noted booster station (project 7.1) to the proposed 655 m reservoir.

   7.3. 655 m Reservoir (Developer Project – Estimated Cost of $1,535,000)

A 2,315 m3 reservoir with a full water level of 655 m will be built at Lakestone. The reservoir will provide balancing and fire flow storage for the 655 m and 690 m pressure zones as shown in **Appendix A**. The reservoir can be filled with water from Swalwell Lake or Okanagan by the 655 m Booster Station (project 7.1).

7.4. Phase 4/5 PRV (Developer Project – Estimated Cost of $260,000)
A PRV will be constructed in the approximate location shown in **Appendix A.** The PRV will provide redundancy in supply to Phase 4 and 5 which is normally supplied by gravity from Swalwell Lake. In the event of supply interruption from Swalwell Lake, Phase 4 and 5 will be supplied by Okanagan Lake via the 655 m reservoir.

7.5. Phase 7 PRV (Developer Project – Estimated Cost of $260,000)
A PRV will be constructed in the approximate location shown in **Appendix A.** The PRV will provide redundancy in supply to Lower Phase 7 which is normally supplied by gravity from Swalwell Lake. In the event of supply interruption from Swalwell Lake, lower phase 7 will be supplied by Okanagan Lake via the 655 m reservoir.

8. Upper Phase 6 Water Supply
Stage 8 works will establish water supply to the Lakestone Upper Phase 6 and lower phase 8.

8.1. Booster Station to 690 m Pressure Zone (Developer Project – Estimated Cost of $1,360,000)
A booster station will be constructed for the primary purpose to convey water from Swalwell Lake via the 655 m reservoir to a boosted 690 m pressure zone. The estimated project cost assumes the station will be equipped with 3 pumps in total. There will be a duty pump, standby pump and fire pump. The station will be equipped with vertical turbine pumps and built on top of the 655 m reservoir. The station will be sized to convey MDD of 2.5 L/s and a fire flow of 200 L/s.

8.2. Phase 8 PRV (Developer Project – Estimated Cost of $270,000)
A PRV will be constructed in the approximate location shown in **Appendix A.** The PRV will provide redundancy in supply to Lower Phase 8 which is normally supplied by gravity from Swalwell Lake. In the event of supply interruption from Swalwell Lake, Lower Phase 8 will be supplied by Okanagan Lake via the 655 m reservoir.

9. Floating Phase Water Supply
Stage 9 works will establish water supply to the Lakestone floating phase.

9.1. Floating Phase Distribution Main and Interconnect (Developer Project – Estimated Cost of $516,000)
A new watermain will be installed to service the floating phase as shown in **Appendix A**. The watermain will connect to a proposed watermain on Okanagan Center Road (project 6.2) that is supplied from the Eldorado site (Swalwell Lake). The proposed watermain is to extend the existing Swalwell Lake distribution main on Chase Road.

6.0 Cost Allocation

The estimated cost for the preferred servicing concept is $19.5M. Of the $19.5M, $10.2M and $9.3M are attributable to the District and the Developer, respectively. Refer to the figure in **Appendix A** for a summary of the costs and **Appendix C** for a detailed breakdown of the estimated costs.

7.0 Conclusions and Recommendations

This updated servicing master plan for Lakestone provides a servicing concept that is consistent with the District's Water Master Plan and provides flexibility to the developer in how it is implemented. The preferred servicing concept takes a proactive risk management approach to address the major sources of risk exposure including:

- Climate Change – 10% capacity built in for climate change resilience.
- Infrastructure Failure – Source and distribution redundancy improved with interconnections and in-system storage increases.
- Changes to Growth and Development – Phasing plan designed to provide flexibility and not overbuild infrastructure until works are needed.

Key recommendations from this review are:

- Confirm water license conversion requirements and complete required conversions
- Complete an updated hydrologic study for the Swalwell Lake source as recommended in the WMP
- Update the District's financial plan to reflect the revised servicing costs

Appendix A

Preferred Servicing Plan

Lakestone Preferred Servicing Plan

Lakestone Servicing and
Water Master Plan Integration

District of Lake Country

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December 23, 2015

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Legend

- Okanagan Lake Source Water
- Beaver Lake Source Water
- Major Lakestone Watermains
- Booster Pump Station
- Pressure Reducing Station (PRV)
- 600m Pressure Zone
- 655m Pressure Zone
- Upper Lakestone Boosted Zone

STAGE 1 · STAGE 2 · STAGE 3 · STAGE 4 · STAGE 5 · STAGE 6 · STAGE 7 · STAGE 8 · STAGE 9

3.3 Stubbs Road Connection (dedicated feed)

Existing PRV Station

1.1 350mm Supply Main (Supply to Phase 3)

3.2 OK Reservoir UV Installation

3.1 Dedicated Distribution Main (600mm)

7.1 Booster to 655m Reservoir including backup from Okanagan Lake source

4.2 Phase 3 PRV

7.2 Dedicated 350mm Supply Main to 655m Reservoir

8.2 Phase 8 PRV

8.1 Booster to 690m PZ

7.4 Phase 4/5 PRV

7.5 Phase 7 PRV

6.3 Connection to Lakestone South East Supply Main

6.2 Lakestone South East Supply Main OK Centre Road

9.1 350mm Floating Phase Distribution Main

7.3 655m Reservoir (2,320 cubic meters)

6.1 Lakestone South East Supply Main Chase Road

5.1 Phase 7 Distribution Piping

4.1 Long Road Supply Main to Road C

2.1 Eldorado Treated Storage (6,000 cubic meters) & Low Lift Booster Station

2.2 Glenmore Road Pump Station (Jim Bailey PS Replacement)

McCoubrey · Plateau · Floating Phase · Phase 2 · Phase 3 · Phase 4 · Phase 5 · Phase 6 · Phase 7 · Phase 8

TYNDALL ROAD · MCCOUBREY ROAD · OK CENTRE ROAD W · GLENMORE ROAD · DICK ROAD · CHASE ROAD · SEATON ROAD · SHANKS ROAD · HARWOOD ROAD · JANET ROAD · READ ROAD · LONG ROAD · CAMP ROAD

District of Lake Country Projects

Water Project	Project Description	Purpose	Project Cost
2.1	Eldorado Low Lift PS and Treated Storage (6,000 cu.m.)	Water Supply	$5,695,000
2.2	Glenmore Road Pump Station (Jim Bailey PS Replacement)	Redundancy	$1,275,000
3.1	OK Reservoir - Dedicated Distribution Main (600mm)	Water Quality - dedicated outlet	$592,000
3.2	OK Reservoir - UV Treatment	Water Quality	$2,565,000
3.3	Stubbs Road Connection	Water Quality - dedicated feed line	$37,000
			$10,164,000

Lakestone Projects

Water Project	Project Description	Purpose	Developable Units	Project Cost
1.1	Tyndall Road 350mm Water main	Supply Main for Lower Phase 3	184	$948,000
4.1	Long Road Supply Main	Upper Phase 3, Phase 4, Lower Phase 5	212	$916,000
4.2	Phase 3 PRV	Water Supply Redundancy for Phase 3		$260,000
5.1	Distribution Piping	Lower Phase 7	108	**TBD**
6.1	Lakestone South-East Supply Main_Chase Road	Floating Phase and Lower Phase 8	132	$414,000
6.2	Lakestone South-East Supply Main_OK Centre Road	Floating Phase and Lower Phase 8		$333,000
6.3	Connection to Lakestone South-East Supply Main	Lower Phase 8		$21,000
7.1	Booster to 655m Reservoir	Upper Phase 5	291	$1,580,000
7.2	Dedicated Supply Main to 655m Reservoir	Lower Phase 6		$633,000
7.3	655m Reservoir (2,315 m3)	Upper Phase 7/8		$1,535,000
7.4	Phase 4/5 PRV	Phase 4/5 Redundancy		$260,000
7.5	Phase 7 PRV	Lower Phase 7 Redundancy		$260,000
8.1	Booster to 690m Pressure Zone	Upper Phase 6	34	$1,360,000
8.2	Phase 8 PRV	Lower Phase 8 Redundancy		$270,000
9.1	Floating Phase Distribution Main and interconnect	Floating Phase	265	$516,000
				$9,306,000

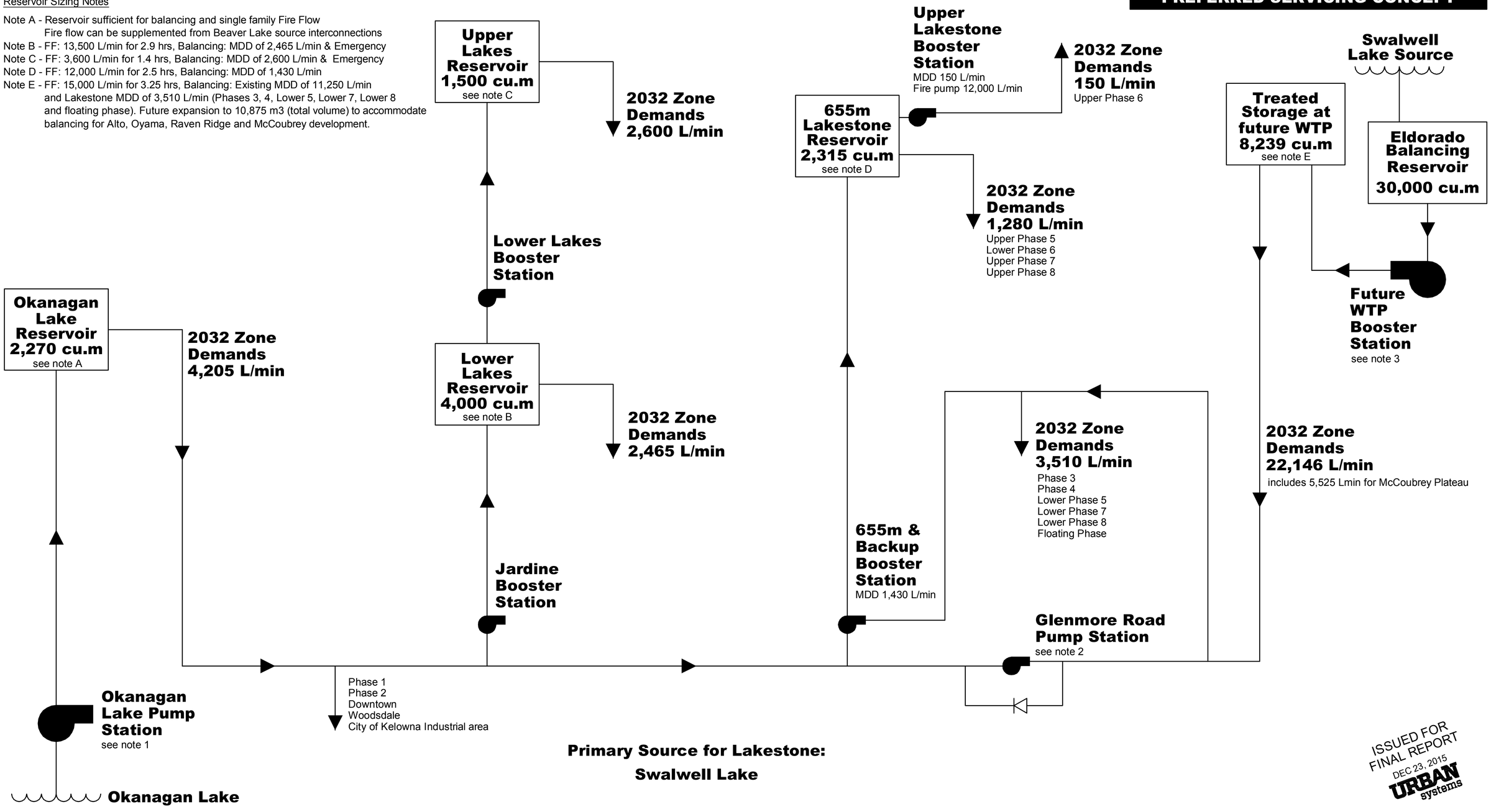
Appendix B

Preferred Servicing Schematic

PREFERRED SERVICING CONCEPT

Reservoir Sizing Notes

Note A - Reservoir sufficient for balancing and single family Fire Flow
Fire flow can be supplemented from Beaver Lake source interconnections
Note B - FF: 13,500 L/min for 2.9 hrs, Balancing: MDD of 2,465 L/min & Emergency
Note C - FF: 3,600 L/min for 1.4 hrs, Balancing: MDD of 2,600 L/min & Emergency
Note D - FF: 12,000 L/min for 2.5 hrs, Balancing: MDD of 1,430 L/min
Note E - FF: 15,000 L/min for 3.25 hrs, Balancing: Existing MDD of 11,250 L/min and Lakestone MDD of 3,510 L/min (Phases 3, 4, Lower 5, Lower 7, Lower 8 and floating phase). Future expansion to 10,875 m3 (total volume) to accommodate balancing for Alto, Oyama, Raven Ridge and McCoubrey development.



Primary Source for Lakestone:
Swalwell Lake

ISSUED FOR FINAL REPORT
DEC 23, 2015
URBAN systems

URBAN systems
urbansystems.ca

Note 1 - Ultimate pumping capacity 27,840 L/min (464 L/s) with addition of third pump. Current capacity 13,920 L/min (232 L/s).
Note 2 - Station must be able to pump 12,000 L/min (200 L/s) from OK source to Eldorado Reservoir. Beaver Lake source can feed Okanagan Lake Reservoir via Glenmore PRV station.
Note 3 - Station must be able to pump 43,200 L/min (750 L/s) to supply Swalwell, Lakestone, Alto and McCoubrey customers. Future expansion to 55,560 L/min (926 L/s) to supply Oyama and Raven Ridge systems.

General: - All demands shown do not include agricultural usage

Client/Project		
DISTRICT OF LAKE COUNTRY AND MACDONALD LAKESHORE PROPERTIES		
Scale	**Date**	**Figure**
N.T.S.	15-05-04	3
1577.0065.01		**Title**

EXISTING & PROPOSED SYSTEM STORAGE/PUMPING REQUIREMENTS

U:\Projects_KEL\1577\0065\01\D-Drafting-Design-Analysis\CAD\C\CURRENT\DESIGN\Option 1 Flow Diagram.dwg, Option 2, 2015/12/23 08:28 am jbarta

Appendix C

Cost Estimates

Tyndall Road 350mm Water main
Cost Estimate

Project # **1.1** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Tie-in to existing watermain	1	ea	$6,000	$6,000
	Remove and dispose existing 250mm watermain	20	m	$50	$1,000
	350mm PVC watermain	1250	m	$410	$512,500
	rock removal allowance	1	ls	$90,000	$90,000
	fire hydrants	4	ea.	$5,500	$22,000
				Subtotal	$631,500
				Engineering & Contingency (50%)	$315,750
				Total (rounded)	$948,000

Eldorado Low Lift PS and Treated Storage (6,000 cu.m.)
Cost Estimate

Project # **2.1** **Job No.** **1577.0065.01**
Date **19/10/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
1	**General**				
	Mobilization and Demobilization	1	ls	150,000	$150,000
	Insurance and bonding	1	ls	60,000	$60,000
				Subtotal	$210,000
2	**Removals**				
	n/a				$0
				Subtotal	$0
3	**Site Works**				
	Access road improvements				$0
	Tie to existing watermain	2	ls	60,000	$120,000
	750 mm PVC C905 pipe	450	lm	500	$225,000
	750mm buried gate valve	2	ea.	25,000	$50,000
	Misc site works (rock removal, restoration, landscaping)	1	ls	50,000	$50,000
	750 mm Reservoir overflow c/w energy diffuser & de-cl2 chamber	1	ls	150,000	$150,000
				Subtotal	$595,000
4	**Pump Station**				
	Building	90	sq.m	2,500	$225,000
	250HP vertical turbine pump (397 L/s @ 30 m) c/w 750 mm SS can	3	ea.	120,000	$360,000
	500 mm SS discharge piping	15	lm	3,500	$52,500
	600 mm SS discharge header	15	lm	4,000	$60,000
	900 mm SS suction header	1	ls	75,000	$75,000
	500 mm check valve	3	ea.	60,000	$180,000
	500 mm butterfly valve	3	ea.	50,000	$150,000
	600 mm flow meter	1	ea.	60,000	$60,000
	pressure transmitter	1	ea.	1,500	$1,500
	pressure gauge	3	ea.	500	$1,500
	level transmitter	1	ea.	1,500	$1,500
	air valve	3	ls	1,000	$3,000
	bridge crane	1	ls	20,000	$20,000
	Electrical and Instrumentation	1	ls	300,000	$300,000
	Electrical service	1	ls	30,000	$30,000
				Subtotal	$1,295,000
5	**Reservoir**				
	CIP concrete	6000	cu.m	300	$1,800,000
	750 mm reservoir inlet and outlet piping	1	ls	300,000	$300,000
	Flygt Bulb	3	ea.	750	$2,250
	Level Transducer	1	ea.	2,250	$2,250
	Electrical and Instrumentation	1	ls	15,000	$15,000
	Electrical service				$0
				Subtotal	$2,119,500
				Subtotal	$4,219,500
				Contingency and Engineering (35%)	$1,476,825
				Total (rounded)	$5,695,000

Glenmore Road Pump Station (Jim Bailey PS Replacement)
Cost Estimate

Project # 2.2 Job No. 1577.0065.01
Date 10/19/2015

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
1	General				
1.1	Mobilization and Demobilization	1	ls	50,000	$50,000
	Insuranace and bonding	1	ls	15,000	$15,000
2	Removals				
	n/a				$0
3	Site Works				
	Access road	1	ls	15,000	$15,000
	Tie to existing watermain	2	ls	60,000	$120,000
	500mm buried gate valve	1	ea.	18,000	$18,000
	350mm buried gate valve	1	ea.	6,000	$6,000
	Suction and discharge header connection (for water hammer)	1	ls	75,000	$75,000
	Chain Link fence	100	lm	50	$5,000
	Misc site works and landscaping	1	ls	10,000	$10,000
	rock removal	1	ls	5,000	$5,000
4	Pump Station				
	Building	80	sq.m	2,500	$200,000
	100HP horizontal split case (100 l/s @ 97 m)	2	ls	45,000	$90,000
	350 mm SS piping	35	lm	1,700	$59,500
	350 mm check valve	2	ea.	4,000	$8,000
	350 mm butterfly valve	4	ea.	3,000	$12,000
	350 mm strainer	2	ea.	5,000	$10,000
	350 mm flow meter	1	ea.	12,000	$12,000
	pressure transmitter	2	ea.	1,500	$3,000
	pressure gauge	4	ea.	500	$2,000
	air valve	4	ea.	1,000	$4,000
	bridge crane	1	ls	20,000	$20,000
	Electrical and Instrumentation	1	ls	175,000	$175,000
	Electrical service	1	ls	30,000	$30,000
				Subtotal	$944,500
				Contingency and Engineering (35%)	$330,575
				Total (rounded)	$1,275,000

OK Reservoir - Dedicated Distribution Main (600mm)
Cost Estimate

Project # 3.1 Job No. 1577.0065.01
Date 10/19/2015

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Tie-in to existing 600mm stub @ reservoir expansion	1	ea	$20,000	$20,000
	600mm PVC watermain (reservoir to OK Centre Road)	230	m	$475	$109,250
	connect to existing 850 mm watermain	1	ea	$60,000	$60,000
	600mm gate valve on distribution main	4	ea	$20,000	$80,000
	utiliy conflicts allowance	1	ls	$50,000	$50,000
	rock removal allowance	1	ls	$60,000	$60,000
	road restoration	10	lm	$1,505	$15,050
				Subtotal	$394,300
				Engineering & Contingency (50%)	$197,150
				Total (rounded)	$592,000

OK Reservoir - UV Treatment
Cost Estimate

Project # 3.2 Job No. 1577.0065.01
Date 6/3/2015

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
1	General				
1.1	Mobilization and Demobilization		ls	100,000	$0
	Insuranace and bonding		ls	25,000	$0
2	Removals				
	n/a				$0
3	Site Works				
	Access road improvements		ls	50,000	$0
	Tie to existing watermain		ls	60,000	$0
	900 mm PVC C905 pipe		lm	990	$0
	900 mm isolation valve		ea.	30,000	$0
	600 mm PVC C905 pipe		lm	660	$0
	600 mm isolation valve		ea.	20,000	$0
	Misc site works and landscaping		ls	50,000	$0
	rock removal		ls	15,000	$0
	600 mm Reservoir overflow c/w energy diffuser & de-cl2 chamber		ls	125,000	$0
4	Reservoir				
	CIP concrete		cu.m	350	$0
	900 mm inlet pipe c/w mixing valves		ls	100,000	$0
	600 mm outlet pipe		ls	50,000	$0
	Flygt Bulb		ea.	750	$0
	Level Transducer		ea.	2,250	$0
					$0
	Electrical and Instrumentation		ls	50,000	$0
	Electrical service		ls	50,000	$0
5	Treatment				$0
	UV	1	ls	1,900,000	$1,900,000
				Subtotal	$1,900,000
				Contingency and Engineering (35%)	$665,000
				Total (rounded)	$2,565,000

Stubbs Road Connection
Cost Estimate

Project # 3.3 Job No. 1577.0065.01

Date 6/3/2015

Prepared by: J.Clowes

Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Tie-in to existing 200mm watermain	1	ea	$6,000	$6,000
	Tie-in to existing 350mm watermain	1	ea	$6,000	$6,000
	Cap existing tee c/w thrust block	1	ea	$2,000	$2,000
	200mm PVC watermain	20	m	$245	$4,900
	200mm gate valve	1	ea	$1,800	$1,800
	350x350x350 mm tee	1	ea	$3,000	$3,000
	350x200mm reducer	1	ea	$800	$800
				Subtotal	$24,500
				Engineering & Contingency (50%)	$12,250
				Total (rounded)	$37,000

Long Road Supply Main
Cost Estimate

Project # **4.1** **Job No.** **1577.0065.01**
Date **03/06/2016**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	350mm PVC watermain	760	ea	$350	$266,000
	75mm asphalt restoration	3150	sq.m	$20	$63,000
	100mm base course gravel restoration	3150	sq.m	$6	$18,900
	350mm subbase course gravel restoration	3150	sq.m	$15	$47,250
	re-connect existing services to new watermains	8	ea	$1,500	$12,000
	tie-in to Camp Road 400mm watermain	1	ea	$10,000	$10,000
	rock removal allowance	1	ls	$165,000	$165,000
	fire hydrants	4	ea.	$5,500	$22,000
	connect to 655m booster	1	ea	$6,000	$6,000
				Subtotal	$610,150
				Engineering & Contingency (50%)	$305,075
				Total (rounded)	$916,000

Phase 3 PRV
Cost Estimate

Project # **4.2** **Job No.** **1577.0065.01**

Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Building (Precon Model BD 3040)	1	ea.	$45,000	$45,000
	Foundation Prep for Building	1	ea.	$10,000	$10,000
	Connect to Existing	2	ea.	$5,000	$10,000
	200 mm PRV	1	ea	$15,000	$15,000
	38 mm PRV c/w isolation valves and piping	1	ls	$5,000	$5,000
	Butterfly valve - 200 mm	2	ea	$1,700	$3,400
	200mm Pipe (schedule 10SS)	15	m	$1,200	$18,000
	200mm strainer	1	ea	$4,000	$4,000
	200mm Mag meter	1	ea	$6,000	$6,000
	Pressure transducer	2	ea.	$1,500	$3,000
	pressure gauge	2	ea	$500	$1,000
	sampling tap	1	ea	$500	$500
	air release	1	ea	$1,000	$1,000
	Electrical Equipment	1	ea.	$30,000	$30,000
	Electrical Service	1	ea.	$15,000	$15,000
	Acess Road and Gravel parking pad	1	ea.	$15,000	$15,000
	Site landscaping and restoration	1	ea.	$10,000	$10,000
				subtotal	$191,900
				Contingency and Engineering (35%)	$67,165
				total	$259,065
				rounded total	$260,000

Lakestone South-East Supply Main_Chase Road
Cost Estimate

Project # **6.1** **Job No.** **1577.0065.01**
Date **19/10/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	350mm PVC watermain	450	ea	$350	$157,500
	tie-in to existing 700 Dick Road watermain	1	ea	$60,000	$60,000
	350 mm gate valve	3	ea	$6,000	$18,000
	rock removal allowance	1	ls	$40,000	$40,000
				Subtotal	$275,500
				Engineering & Contingency (50%)	$137,750
				Total (rounded)	$414,000

Lakestone South-East Supply Main_OK Centre Road
Cost Estimate

Project # **6.2** **Job No.** **1577.0065.01**
Date **19/10/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	350mm PVC watermain	550	ea	$350	$192,500
	350 mm gate valve	2	ea	$6,000	$12,000
	tie-in	1	ea	$6,000	$6,000
	fire hydrants	2	ea.	$5,500	$11,000
				Subtotal	$221,500
				Engineering & Contingency (50%)	$110,750
				Total (rounded)	$333,000

Connection to Lakestone South-East Supply Main
Cost Estimate

Project # 6.3 Job No. 1577.0065.01
Date 6/3/2015

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	75mm asphalt restoration	32	sq.m	$20	$640
	100mm base course gravel restoration	32	sq.m	$6	$192
	350mm subbase course gravel restoration	32	sq.m	$15	$480
	tie-in to proposed OK Centre Road 350mm watermain	1	ea	$6,000	$6,000
	350mm PVC watermain	15	ea	$410	$6,150
				Subtotal	$13,462
				Engineering & Contingency (50%)	$6,731
				Total (rounded)	$21,000

Booster to 655m Reservoir
Cost Estimate

Project # **7.1** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
1	**General**				
1.1	Mobilization and Demobilization	1	ls	50,000	$50,000
	Insuranace and bonding	1	ls	15,000	$15,000
2	**Removals**				
	n/a				$0
3	**Site Works**				
	Access road	1	ls	15,000	$15,000
	Tie to existing watermain	2	ls	5,000	$10,000
	200mm C900 PVC Pipe	20	lm	200	$4,000
	200mm buried gate valve	2	ea.	1,300	$2,600
	Chain Link fence	100	lm	50	$5,000
	Misc site works and landscaping	1	ls	10,000	$10,000
	rock removal	1	ls	5,000	$5,000
4	**Pump Station**				
	Building	160	sq.m	2,200	$352,000
	25HP horizontal split case pump	2	ea.	30,000	$60,000
	75HP vertical turbine pump	2	ea.	60,000	$120,000
	150 mm SS piping	20	lm	1,500	$30,000
	200 mm SS header	60	lm	1,600	$96,000
	150 mm check valve	4	ea.	2,000	$8,000
	150 mm butterfly valve	2	ea.	1,500	$3,000
	200 mm flow meter	1	ea.	5,000	$5,000
	200 mm strainer	2	ea.	4,000	$8,000
	pressure transmitter	4	ea.	1,500	$6,000
	level transmitter	1	ea.	1,500	$1,500
	pressure gauge	4	ea.	500	$2,000
	surge control allowance	1	ls	30,000	$30,000
	air valve	5	ea.	1,000	$5,000
	200 mm reservoir fill line c/w flow meter	1	ls	25,000	$25,000
	cast in place concrete wet well	75	cu.m	700	$52,500
	bridge crane	1	ls	20,000	$20,000
	Electrical and Instrumentation	1	ls	200,000	$200,000
	Electrical service	1	ls	30,000	$30,000
				Subtotal	$1,170,600
				Contingency and Engineering (35%)	$409,710
				Total (rounded)	$1,580,000

Dedicated Supply Main to 655m Reservoir
Cost Estimate

Project # **7.2** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	200mm PVC watermain	1850	ea	$220	$407,000
	air release valve	1	ea	$15,000	$15,000
	tie-in to 655m booster pump				$0
	tie-in to 655m reservoir				$0
				Subtotal	$422,000
				Engineering & Contingency (50%)	$211,000
				Total (rounded)	$633,000

655m Reservoir (2,315 m3)
Cost Estimate

Project # **7.3** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
1	**General**				
1.1	Mobilization and Demobilization	1	ls	100,000	$100,000
	Insuranace and bonding	1	ls	20,000	$20,000
					$0
2	**Removals**				$0
	n/a				$0
					$0
3	**Site Works**				$0
	Access road improvements				$0
	Tie to existing watermain	1	ls	6,000	$6,000
	350 mm PVC C905 pipe (gravity outlet)	10	lm	350	$3,500
	350 mm buried gate valve (on gravity outlet)	1	ea.	6,000	$6,000
	Misc site works and landscaping	1	ls	50,000	$50,000
	rock removal	1	ls	30,000	$30,000
	dechlorination manhole	1	ls	15,000	$15,000
	overflow pipe	1	ls	30,000	$30,000
					$0
4	**Reservoir**				$0
	CIP concrete	2315	cu.m	350	$810,250
	200 mm inlet pipe c/w mixing valves	1	ls	30,000	$30,000
	200 mm reservoir fill line c/w flow meter and control valve				$0
	Flygt Bulb	3	ea.	750	$2,250
	Level Transducer	1	ea.	2,250	$2,250
	350 mm gravity outlet	1	ls	15,000	$15,000
					$0
	Electrical and Instrumentation	1	ls	15,000	$15,000
	Electrical service				$0
				Subtotal	$1,135,250
				Contingency and Engineering (35%)	$397,338
				Total (rounded)	$1,535,000

Phase 4/5 PRV
Cost Estimate

Project # **7.4** **Job No.** **1577.0065.01**

Date **03/06/2015**

Prepared by: J.Clowes

Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Building (Precon Model BD 3040)	1	ea.	$45,000	$45,000
	Foundation Prep for Building	1	ea.	$10,000	$10,000
	Connect to Existing	2	ea.	$5,000	$10,000
	200 mm PRV	1	ea	$15,000	$15,000
	38 mm PRV c/w isolation valves and piping	1	ls	$5,000	$5,000
	Butterfly valve - 200 mm	2	ea	$1,700	$3,400
	200mm Pipe (schedule 10SS)	15	m	$1,200	$18,000
	200mm Mag meter	1	ea	$6,000	$6,000
	200mm strainer	1	ea.	$4,000	$4,000
	Pressure transducer	2	ea.	$1,500	$3,000
	pressure gauge	2	ea	$500	$1,000
	sampling tap	1	ea	$500	$500
	air release	1	ea	$1,000	$1,000
	Electrical Equipment	1	ea.	$30,000	$30,000
	Electrical Service	1	ea.	$15,000	$15,000
	Acess Road and Gravel parking pad	1	ea.	$15,000	$15,000
	Site landscaping and restoration	1	ea.	$10,000	$10,000
				subtotal	$191,900
				Contingency and Engineering (35%)	$67,165
				total	$259,065
				rounded total	$260,000

Phase 7 PRV
Cost Estimate

Project # **7.5** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Building (Precon Model BD 3040)	1	ea.	$45,000	$45,000
	Foundation Prep for Building	1	ea.	$10,000	$10,000
	Connect to Existing	2	ea.	$5,000	$10,000
	200 mm PRV	1	ea	$15,000	$15,000
	38 mm PRV c/w isolation valves and piping	1	ls	$5,000	$5,000
	Butterfly valve - 200 mm	2	ea	$1,700	$3,400
	200mm Pipe (schedule 10SS)	15	m	$1,200	$18,000
	200mm Mag meter	1	ea	$6,000	$6,000
	200mm strainer	1	ea.	$4,000	$4,000
	Pressure transducer	2	ea.	$1,500	$3,000
	pressure gauge	2	ea	$500	$1,000
	sampling tap	1	ea	$500	$500
	air release	1	ea	$1,000	$1,000
	Electrical Equipment	1	ea.	$30,000	$30,000
	Electrical Service	1	ea.	$15,000	$15,000
	Acess Road and Gravel parking pad	1	ea.	$15,000	$15,000
	Site landscaping and restoration	1	ea.	$10,000	$10,000
				subtotal	$191,900
				Contingency and Engineering (35%)	$67,165
				total	$259,065
				rounded total	$260,000

Booster to 690m Pressure Zone
Cost Estimate

Project # **8.1** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
1	**General**				
1.1	Mobilization and Demobilization	1	ls	50,000	$50,000
	Insuranace and bonding	1	ls	15,000	$15,000
2	**Removals**				
	n/a				$0
3	**Site Works**				
	Access road	1	ls	15,000	$15,000
	Tie to existing watermain	2	ls	6,000	$12,000
	350mm C905 PVC Pipe	10	lm	350	$3,500
	350mm buried gate valve	1	ea.	6,000	$6,000
	200mm C900 PVC pipe	10	lm	200	$2,000
	200mm gate valve	1	ea.	1,300	$1,300
	Chain Link fence	100	lm	50	$5,000
	Misc site works and landscaping	1	ls	10,000	$10,000
	rock removal	1	ls	5,000	$5,000
4	**Pump Station**				
	Building	90	sq.m	2,200	$198,000
	150HP vertical turbine pump	1	ls	60,000	$60,000
	5HP vertical turbine pump	2	ls	15,000	$30,000
	100 mm SS discharge piping	10	lm	800	$8,000
	350 mm SS piping	15	lm	1,600	$24,000
	100 mm check valve	2	ea.	2,000	$4,000
	350 mm check valve	1	ea.	3,500	$3,500
	100 mm butterfly valve	2	ea.	1,200	$2,400
	350 mm butterfly valve	1	ea.	5,000	$5,000
	350 mm flow meter	1	ea.	12,000	$12,000
	pressure transmitter	1	ea.	1,500	$1,500
	pressure gauge	3	ea.	500	$1,500
	level transmitter	1	ea.	1,500	$1,500
	300 mm reservoir fill line c/w flow meter	1	ls	30,000	$30,000
	cast in place concrete wet well				$0
	surge control allowance	1	ls	50,000	$50,000
	air valve	2	ea.	1,000	$2,000
	bridge crane	1	ls	20,000	$20,000
	Electrical and Instrumentation	1	ls	150,000	$150,000
	Electrical service	1	ls	30,000	$30,000
	backup generator	1	ls	250,000	$250,000
				Subtotal	$1,008,200
				Contingency and Engineering (35%)	$352,870
				Total (rounded)	$1,360,000

Phase 8 PRV
Cost Estimate

Project # 8.2 Job No. 1577.0065.01
Date 6/3/2015
Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	Building (Precon Model BD 3040)	1	ea.	$45,000	$45,000
	Foundation Prep for Building	1	ea.	$10,000	$10,000
	Connect to Existing	2	ea.	$5,000	$10,000
	250 mm PRV	1	ea	$17,000	$17,000
	38 mm PRV c/w isolation valves and piping	1	ls	$5,000	$5,000
	Butterfly valve - 250 mm	2	ea	$1,900	$3,800
	250mm Pipe (schedule 10SS)	15	m	$1,300	$19,500
	250mm Mag meter	1	ea	$6,500	$6,500
	250mm strainer	1	ea.	$5,500	$5,500
	Pressure transducer	2	ea.	$1,500	$3,000
	pressure gauge	2	ea	$500	$1,000
	sampling tap	1	ea	$500	$500
	air release	1	ea	$1,000	$1,000
	Electrical Equipment	1	ea.	$30,000	$30,000
	Electrical Service	1	ea.	$15,000	$15,000
	Acess Road and Gravel parking pad	1	ea.	$15,000	$15,000
	Site landscaping and restoration	1	ea.	$10,000	$10,000
				subtotal	$197,800
				Contingency and Engineering (35%)	$69,230
				total	$267,030
				rounded total	$270,000

Floating Phase Distribution Main and interconnect
Cost Estimate

Project # **9.1** **Job No.** **1577.0065.01**
Date **03/06/2015**

Prepared by: J.Clowes
Checked by: S. Brubacher

ITEM	DESCRIPTION	QTY	UNIT	$/UNIT	EXTENDED
	350mm PVC watermain	470	ea	$410	$192,700
	200mm PVC watermain	360	ea	$245	$88,200
	tie-in to existing Chase Road 200mm watermain	1	ea	$6,000	$6,000
	rock removal allowance	1	ls	$35,000	$35,000
	fire hydrants	4	ea.	$5,500	$22,000
				Subtotal	$343,900
				Engineering & Contingency (50%)	$171,950
				Total (rounded)	$516,000