3.0 Potable Water Systems

3.1 POTABLE WATER SOURCES

Based on the report *Ground Water Evaluation – Chinook Ridge Lodge and Golf Course, SE-31-28-3-W.5 Stantec, December 2010* **(Appendix F)**, the source well (Well # 3) and two monitoring wells (MW-1 and MW-2) were drilled and found to supply sufficient groundwater for year-round operation of the lodge and restaurant. According to the report the production well is completed to a depth of 13.7 meter below land surface (bls) and has a 12.55 cm diameter casing. The rated capacity of the Well 3 is 64.4 cubic meters per day. Based on the interpretation of the aquifer tests, an average transmissive capacity of 62.6 m^2/day was calculated and a storativity of 0.00085. However during peak demand the well can be pumped at rates up to 98.2 m^3/day for short periods of time during summer months.

The regional groundwater assessment for Rocky View County (2002) indicates that groundwater in the area is mainly of the sodium-sulphate to bicarbonate type. The water results indicate that the water is moderately hard (427 mg/L of hardness) but none of the parameters exceed the standards of the “Guidelines for Canadian Drinking Water Quality”.

Figures 3.1 and **3.2** provide additional information on well locations in the area and on the subject property.

3.2 POTABLE WATER DEMAND

Potable water demands shown in **Table 3.1**, will include the main lodge are described in the table below. Water usages are based on Alberta Environment’s *Standard and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems (2006)*.

Table 3.1 Chinook Ridge Lodge Estimated Water Use

Component	Assumptions	Daily Flow (m^3)	Monthly Flow (m^3)	Annual Flow (m^3)	Estimate Details
Hotel Private Rooms	21 rooms with 2 beds each (2 persons per room)	3.8	115	1,380	90 L/day/bed Based on AENV's *Standard and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage (2006)*
Hotel Public Washrooms	2 showers 21 water closets	17.3	520	6,300	1,800 L/day/shower 550 L/day/water closet 350 L/day/urinal

and Showers	6 urinals				Based on B.C. *Sewage System Standard Practice Manual (2007)*
RV Park	15 spaces	2.7	82	988	180 L/day/space Based on AENV's *Standard and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage (2006)*
Cabins	15 cabins (considered "dwellings") Not serviced but included in calculations. 2 persons per cabin.	2.7	82.4	989	90 L/day/bed Based on AENV's *Standard and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage (2006)*
Banquet Hall	500 seating capacity	15	458	5,496	30 L/day/seat Based on B.C. *Sewage System Standard Practice Manual (2007)*
Esthetician Station	2 stations with no water service	0	0	0	*Not applicable*
Pro-Shop	Considered small dry goods store	0.3	10	150	379 L/day Based on B.C. *Sewage System Standard Practice Manual (2007)*
Whirl Pool	Assumed to be 7 m^3 volume	7	210	2,550	Based on entire volume replaced each day
TOTAL		**48.8**	**1,488**	**17,856**	

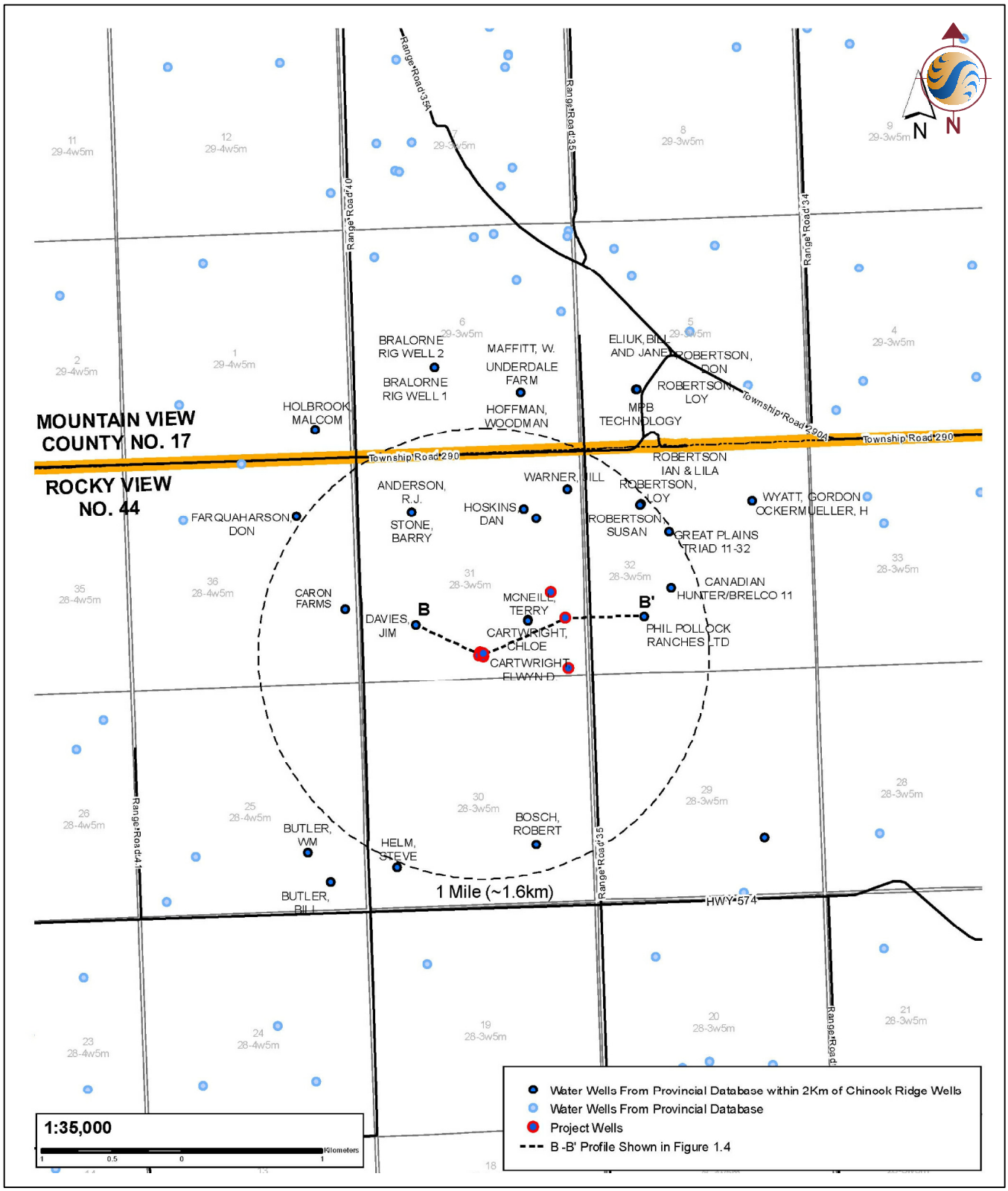

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Figure No.

3.1

Title

Locations of Wells Near Chinook Ridge

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3.2

Title

Details Of Golf Course Area

3.3 WATER TREATMENT

Based on the hydrogeological report *Chinook Ridge Hydrological Report, Stantec, 2011* **(Appendix F)**, the ground water source is considered to be high quality groundwater. Chinook's high quality ground water system will be designed to comply with the following documents however does not require Environmental Protection and Enhancement Act (EPEA) registration with Alberta Environment as the development is contained on a single parcel with one land owner:

- Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage System January 2006
- Guidelines for Canadian Drinking Water Quality, Sixth edition, 1996
- Guide to Requirements for Regulated Waterworks Systems using High Quality Ground Water, December 2004
- Potable Water Regulation
- Environmental Protection and Enhancement Act
- Water Act
- Alberta Safety Codes Act
- Code Of Practice For High Quality Groundwater, 2004

High quality groundwater does not require treatment for health-related parameters. Generally this means that the water, in its natural untreated state, meets all chemical and radiological Maximum (and Interim Maximum) Acceptable Concentrations (MAC/IMAC) as specified in the Guidelines for Canadian Drinking Water Quality (GCDWQ), and for those parameters listed in the Compliance Monitoring section of the *Standards and Guidelines* document. One exception is for naturally occurring fluoride, which is acceptable up to a level of 2.4 mg/L.

The site's high quality groundwater water will be used for drinking, food preparation, cleaning, laundry services, toilet and urinal flushing.

The current hardness level of the well water is 427 mg/L, which does not exceed the standards of the Guidelines for Canadian drinking water quality. However the excessive hardness can create scaling within the water pipes and heaters over time resulting in reduced flow to taps and appliances. Scale buildup will reduce the efficiency and life of water heaters. Soaps and detergents may lose effectiveness. As a result more detergent may be required. To reduce the scaling potential and improve aesthetic purposes, the water will be partially treated by an ion exchange water softener. The average hardness of the well water is 427 mg/l. By partially

softening the water, we can reduce the calcium and magnesium hardness to between 200 and 300 mg/l while maintaining sodium levels ≤ 200 mg/l for aesthetic (taste) reasons and in consideration of persons suffering from hypertension and congestive heart illness. The resulting sodium levels in the water treated by ion exchange process (sodium zeolite) are not expected to create problems with treated wastewater irrigation. Addition detail on irrigation water quality including sodium absorption rates can be found in **Section 6.0.**

The water system proposed for Chinook Lodge will comprise of a well pump, water softener system, tank storage, jet/booster pump bladder tank and inline hypochlorite system. The water treatment process flow diagram is illustrated in **Figure 3.3**

3.3.1 Water Distribution

A community water distribution system will consist of conveyance from the well to the main lodge for treatment and storage. The main lodge will be serviced from a pressure supply system to maintain operating pressure between 40 - 60 psi and a pipe will be constructed to a water filling station to be used by the recreational vehicles at the campsite. Individual campsites will not be serviced with potable water. Due to the amount of available groundwater and the sensitivity of the local groundwater aquifer, groundwater will not be provided for landscape or golf course irrigation.

3.3.2 Potable Water Storage

Traditional water storage facilities in a water supply distribution system are required primarily to deal with fluctuating demands of water usage while supplying adequate pressure. In an efficient water distribution system, water will be pumped into the storage tank during periods of low demand, such as at night. During the daily peak water usage (morning, late evening), water is pumped out of the storage tank and into the distribution system. A properly functioning storage reservoir provides sufficient storage that minimizes interruption of supply due to failures of mains, pumps, and other equipment.

As per the “Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems” the total water storage requirements for a given water supply system where the water treatment system is only capable of satisfying the maximum daily design flow shall be calculated using the following empirical formula:

S = A+B+ (the greater of C or D)

Where S = Total storage requirement, m^3
A = Fire Storage m^3
B = Equalization storage (approximately 25% of projected maximum daily design flow), m^3
C = Emergency Storage (minimum of 15% of projected average daily design flow), m^3
D = Disinfection contact time (T_{10}) storage to meet the CT requirements, m^3

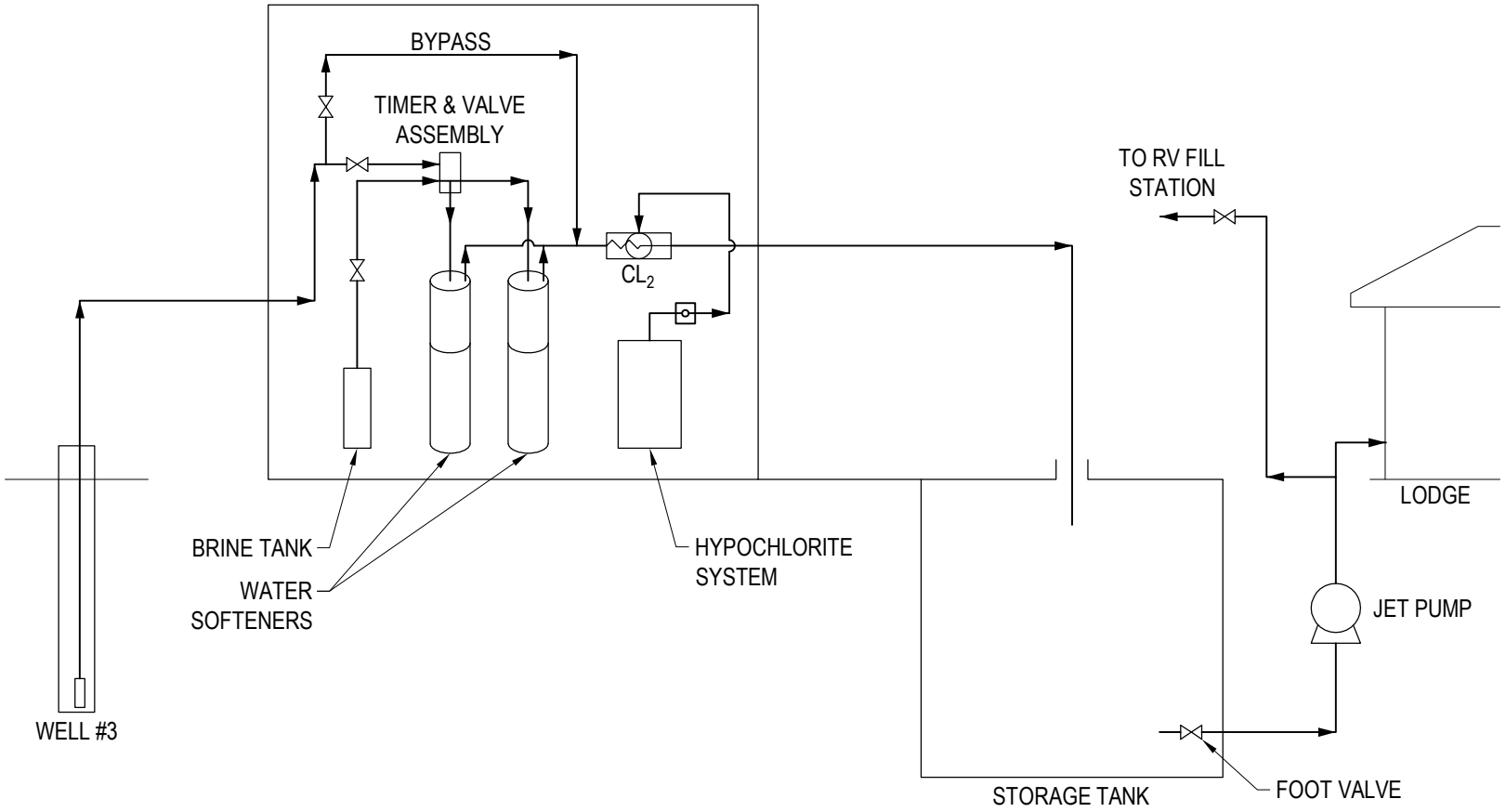

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Figure No.

3.3

Title

System Process Diagram

For the current system A = 0 due to the building design standard and D = 0 since the potable water source is high quality ground water. The requirement to have a 4-log reduction for viruses is only required when a registration is required, however to protect public health and safety, Chinook will provide disinfection by adding chlorine to maintain a residual and meet the 4-log reduction for viruses. Total storage requirement is approximately 19.5 m^3 (40% of maximum daily flow).

Water will be stored in a below ground storage tank. The below ground storage tank will be identifiable from the surface and located in an area accessible for servicing. The storage tank will be sized to handle the expected peak demand. The well pump pressurizes the main line to the lodge. The water from this line is softened using ion exchange and disinfected using an inline chlorination system and discharged into the storage tank.

From the storage tank, a jet pump will be installed to provide peak flows to the lodge. This jet pump will feed a small hydro-pneumatic tank that will deliver water to the facility under a constant pressure.

3.3.3 Disinfection

A sodium hypochlorite system is proposed to add chlorine to the potable water main line from the well pump after softening. The system will be located in the treatment building (lodge) and will consist of a 200 liter hypochlorite solution tank, metering scale, chlorine injection metering pumps, an inline mixer and a residual chlorine analyzer. The metering pumps can be adjusted to deliver the desired/required amount of chlorine to maintain a minimum CT requirement (as a best practice method for drinking water) of 8 mg/l/min (as per AENV standards for CT requirement for 4-log reduction of viruses for water at 5^{o}C) which corresponds to a contact time of 134 min with a baffling factor of 0.3 (to accommodate any short circuiting in the storage tank) and a residual of 0.2 mg/l at the fixture). The contact time can be easily maintained due to the 40% storage capacity of the underground storage tank.
The distribution layout is illustrated in **Figure 3.4**.

3.3.4 Operations & Monitoring

Alberta Environment does not require a registration for the proposed potable water system due to the development having a single owner on a single parcel of land. It therefore does not require a water treatment facility operator. Chinook is however proposing to monitor the system as per the requirements outlined in the *Water & Wastewater Operators' Certification Guidelines* published by Alberta Environment to ensure public Health and Safety at all times.

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INTEGRATED WATER MANAGEMENT PLAN

Figure No.

3.4

Title

Water Distribution System

Table 3.2 Minimum Waterworks System Operator Certificate of Qualification Requirements			
Population Served by Waterworks System	**Type of Treatment in the Waterworks System**	**Minimum Number and Minimum Qualifications of Water Treatment Certified Operator(s)**	**Minimum Number and Minimum Qualifications of Water Distribution Certified Operator(s)**
< 500	Class 1 WT facility or systems without treatment	One operator with a Small Water Systems Certificate	

The annual monitoring requirements are listed under *Code of Practice for Waterworks Systems Using High Quality Groundwater Table 5-1 and 5-2*. A summary of monition activities include:

- Trihalomethanes (THM's)
- Bacteriological Analysis
- Chlorine Residual
- Chemical inorganic and organic constituents

Chlorine samples will be taken from the storage tank and will be analyzed for residual chlorine as per **Table 3.3**

Table 3.3 Potable Water Monitoring Location and Frequency				
Parameter	**Type of System**	**Sample Type**	**Monitoring Location**	**Minimum Monitoring frequency and Minimum Number of samples**
Bacteriological	All systems	Grab	At random location(s) within the water distribution	The frequency and number of samples as set out in the GCDWQ, without any reduction
Volume for CT calculation	All systems	Calculated based on controlled minimum water volume	Clear well reservoir	Calculated and reported when setting or changing minimum volume point.
Chlorine Residual	All systems	Grab	(a) At the same location as the bacteriological quality sample is	(a) One sample taken at the time as the bacteriological quality sample is collected and

			collected and (b) At random locations within the water distribution system	(b) One sample per day, five days per week; if a statutory holidays falls on a weekday within that week, the sample is not required on that day, and the frequency may be reduced by one day for each statutory holiday
The physical, organic and inorganic chemical and pesticide parameters listed in the Compliance monitoring section of the Standards and Guidelines Document, except UV absorbance, trihalomethanes and chloramines	Single well system	Grab	After treatment within the water distribution system	One sample per year. Despite this requirement, if the results of the most recent samples indicate that the applicable MAC has been complied with, the (a) physical and inorganic chemical parameters shall be sampled once every three years, and (b) organic chemical and pesticide parameters shall be sampled once every five years.