AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER LOCATION: Hudson's Hope – P.R. Land District.

REFERENCE NUMBER: 0440

DESCRIPTIVE LOCATION: Hudson's Hope and extending 7 Km along north shore of Peace River.

NTS MAP SHEET: 94 A 4

BCGS Map Sheet: 094 A 001

CLASSIFICATION: III B **RANKING VALUE: 9**

Aquifer Size:

13.18 km^2.

Aquifer Boundaries:

This unconsolidated sand and gravel aquifer was delineated on the basis of surficial geology (Thurber, 1976), the Peace River and well development. The boundary is solid along the river where aquifer is well defined and dashed away from the river where boundary location is less certain.

Geologic Formation (overlying):

Well records show dry gravel, sand and gravel, and a confining layer of silt clay and gravel overlying the aquifer.

Geologic Formation (aquifer):

Glaciofluvial sand and gravel underlying recent alluvial and ice contact or lacustrine deposits (sand, silt, gravel and clay). Aquifer thickness is generally less than 6.1 m (20 feet) as indicated on well logs.

Confined / Partially confined / Unconfined:

The aquifer is confined by silt or silt and gravel or silt and clay layers. The thickness of the confining layer ranges from 5.5 to 42.7 m (18 to 140 ft). All well logs indicate a confining layer.

Vulnerability:

Moderate. Wells are located in a glaciofluvial sand and gravel aquifer confined by silt or silty gravel. The confining layer thickness is 5.5 to 42.7 m (18 to 140 ft). Since the confining material is granular it is considered to be leaky. The confining layer is present at all well sites.

Productivity:

Moderate. Reported well yields range between 0.32 to 6.3 L/s (5 and 100 USgpm). The median and geometric mean well yields are 0.82 and 1.14 L/s (13 and 18 USgpm) respectively. Well yields reported are from driller's estimates from short term pumping tests and may be inaccurate. No pumping test data is available. Two springs in Hudson's Hope, Vital Spring and Federal Spring have yields estimated according to their water licenses, both are licensed for 100,000 gpd. One well (WTN 81648) encountered sand and gravel at 135 m. (442 feet) deep. This 4 m (13 ft.) thick layer was pumped by air lift at 8.2 L/s (130 USgpm) with the casing open at the bottom (no screen installed). This well and others in the aquifer could produce more water with screens installed.

Depth to Water Table:

Aquifer 0440 is an artesian aquifer or the water in the aquifer is under pressure and the water level in wells here are well above the uppermost level of the aquifer. Water levels range from 21.3 m. to 39.6 m. (70 to 130 feet) but depths to the top of the aquifer range from 18.3 m. to 74.7 m. (60 to 245 feet). Water levels have been measured only once and will likely vary seasonally.

Direction of Groundwater Flow:

Unknown, insufficient data available for determination.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow). The aquifer is also likely recharged by leakage from the overlying geologic formation and by lateral flow parallel with the Peace River Valley. An upslope recharge component is evident due to the artesian pressure.

Domestic Well Density:

Low. There are 15 wells (2 springs) in this aquifer of approximately 13.18 km^2. Hence the well density is low, about 1.14 well/ km^2.

Type of Water Use:

Wells here are mixed domestic and municipal (2 springs and 1 well).

Reliance on Source:

Well water is the only known source of domestic and municipal water however the river may also be used as a drinking water source.

Conflicts Between Users:

None reported.

Quantity Concerns (type, source, level of concern):

None documented. Water quality generally good. All domestic wells provide greater than 0.3 L/s (5 gpm) much more than a single family residence requires.

Quality Concerns (type, source, level of concern):

None documented. One well record indicates water with high iron and hard water. No health concerns noted. Further water quality testing is recommended.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

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Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

McLean, F.H., Kindle, E.D. 1950. *Geological Survey of Canada, Memoir 259; Geology of Northeastern British* Columbia, Canada Department of Mines and Technical Surveys, Kings Printer Ottawa.

Thurber Consultants Ltd., Lower Peace River Sites C and E Hydroelectric Development Proposals Environmental Resource Atlas, Report to BC Hydro & Power Authority, Victoria, BC.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Hudson's Hope and extending 7 Km along the North Shore of the Peace River.

AQUIFER REFERENCE NUMBER: 0440

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III B	**RANKING VALUE: 9**

Classification Component:

Level of Development: Light. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination introduced at ground surface.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**2**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0440:

Total number of wells available for statistical analysis: **15**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	12	9	1	14	12
Maximum	455	130	170	100	140
Minimum	80	70	170	5	0
Average	186	101	N/A	37	52
Median	143	105	N/A	13	39
Geometric Mean	159	99	N/A	18	5

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

REFERENCE NUMBER: 0441

DESCRIPTIVE LOCATION: Lynx Creek, 7 Km Northeast of Hudson's Hope - Peace River Land District.

NTS MAP SHEET: 94 A 4

BCGS MAP SHEETS: 94 A. 001 / 011 / 012

CLASSIFICATION: III B **RANKING VALUE: 10**

Aquifer Size:

13.61 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of well development, geographical features (Peace River) and bedrock type. The boundaries of this aquifer have been shown as solid along the Peace River north shore and as dashed (less certain) where the boundary is defined by well development.

Geologic Formation (overlying):

Well records indicate a variable thickness of sand/gravel silt, clay or till overlies the bedrock. Well records show a maximum thickness of clay confining layer over the aquifer of 48m. (157 ft.). According to the surficial geology maps (Thurber, 1976) interpret the overlying deposits to be glaciofluvial (sand/gravel) and glaciolacustrine (silt and clay) in origin. Some small alluvial fan deposits exist where small water courses enter Peace River. Only one well record shows glacial till.

Geologic Formation (aquifer):

Bedrock of Mesozoic Era, Upper and Lower Cretaceous Age. Gates Sandstone and Sulley or Moosebar Shale Members. Well records generally describe the bedrock as *layered* sandstone and shale or siltstone. The bedrock is often described as broken or fractured.

Confined/Unconfined:

The aquifer is confined with windows of vulnerability as some rock outcrops occur.

Vulnerability:

Moderate. Wells are completed in a bedrock aquifer that is partially confined from ground surface by material described as clay silt and till. The thickness of confining material ranges between 0 and 48 m. (0 and 157 ft.) thick. The median and geometric mean thickness of this confining material has been determined as 3.3 and 12.2 m. (11 and 40 ft.) thick respectively. The average thickness of confining material has been determined as 12.2 m (40 ft).

Productivity:

Moderate. Reported well yields range between 0.05 and 1.83 L/s (0.8 and 29 USgpm). The median and geometric mean well yields are 0.38 and 0.5 L/s (6 and 8 USgpm) while the average yield has been determined as 0.63 L/s (10 USgpm). Well yields reported are estimated by the driller based on short-term bail or air- tests only and results obtained are often unreliable. No pumping test data are available.

Depth to Water Table:

Only a few groundwater levels were reported at the time of well construction. Groundwater levels reported are variable ranging between 4.6 and 45 m. (15 and 148 ft.), this wide range is due to well head elevation differences. Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation (from the North and Northwest toward Peace River).

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface, and from upslope bedrock outcrop zones.

Domestic Well Density:

Low. There are approximately 1.2 wells / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

The only reported type of use for well water is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use. Peace River may be used for other purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

No direct documentation for this concern but one well (WTN 80257) was called a dry hole despite the yield of 0.8 USgpm also noted.

Quality Concerns (type, source, level of concern):

Not documented. One well record, (WTN 213) however, reports a high hardness and iron. Although there is limited documentation of groundwater quality from wells located within this aquifer, it is probable that groundwater from this bedrock aquifer is moderately hard and often with elevated iron and or manganese.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. *Soil Survey of the Peace River Area in British Columbia.* Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

McMechan, M.E., 1994. Map 1858A. *Geology and Structure Cross-Section, Dawson Creek, BC.* Geological Survey of Canada. NTS File 93P.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING:

AQUIFER LOCATION: Lynx Creek, 7 Km Northeast of Hudson's Hope. - Peace River Land District.

AQUIFER REFERENCE NUMBER: 0441

AQUIFER TYPE: Bedrock

CLASSIFICATION: III B	**RANKING VALUE: 10**

Classification Component:

Level of Development: Light. Low level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination introduced at ground surface.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**2**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0441:

Total number of wells available for statistical analysis: **16**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	16	11	15	16	15
Maximum	300	148	169	29	157
Minimum	26	15	**7**	1	0
Average	170	100	95	10	40
Median	155	100	90	8	40
Geometric Mean	146	90	78	6	11

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0442

AQUIFER LOCATION: 3.5 Km West of Taylor – Peace River Land District.

NTS MAP SHEET: 94 A 2

BCGS MAP SHEET: 094 A. 017

CLASSIFICATION: II A **RANKING VALUE: 12**

Aquifer Size:

1.9 km^2.

Aquifer Boundaries:

This small unconsolidated aquifer has been delineated on the basis of well development, topography, and surficial geology.

Geologic Formation (overlying):

Recent alluvial fan and glacio-lacustrine deposits (sand and silt) overly the aquifer.

Geologic Formation (aquifer):

The aquifer is an alluvial gravel terrace. The dominant aquifer material is sand and gravel.

Confined/Unconfined:

The aquifer is partially confined by a thin layer of silt and sand. A silt and clay layer occurred at one test hole.

Vulnerability:

High. Wells are completed in an unconsolidated aquifer that is only partially confined from ground surface by mainly silt and sand. A number of test holes suggest that the only protection against contamination introduced at the ground surface is a thin layer of silt 1.8 m (6 feet) thick. The median and geometric mean thickness of confining material (silt/sand/clay) has been determined as 3.9 and 3.3 m. (13 and 11 ft.) respectively. The average thickness of confining material has been determined as 3.6 m. (12 ft.).

Productivity:

High. One well (#7, UMA Test Production Well) has been pump tested (results attached) with a safe yield calculated at 20 L/s (317gpm). Other test holes indicate more wells with similar yields could be completed. The transmissivity of Well #7 has been determined as 5×10^{-2} m^2/s (250,000 Igpd/ft.). It is apparent that the test holes have not been pump tested. Test holes have shown evidence of several thin water-bearing formations with layers of finer material. As the depth to shale bedrock is relatively shallow, the aquifer appears to have limited available drawdown.

Depth to Water Table:

Groundwater levels are shallow and range between 1.8 and 7.4 m (6 and 24 ft). The median and geometric mean depth to groundwater has been determined as 4.9 and 4.9 m (16 and 16 ft) respectively, while the average depth to groundwater has been determined as 5.2 m (17 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Groundwater elevations measured at the testholes indicates groundwater flow from the northeast to southwest or toward the Peace River from the terrace.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) and from the creek that flows to the Terrace from the north. Additionally heavy pumping at a production well(s) here will reverse the groundwater flow direction and water will flow from the river toward the well(s).

Domestic Well Density:

There are no domestic wells reported to be located within this aquifer. The one test production well completed is for municipal water supply for Fort St. John.

Type of Water Use:

The test wells and production well here were completed in 1993 as part of a PFRA study and a Development Program conducted by UMA Engineering Ltd.

Reliance on Source:

It is understand Fort St. John has surface water source(s) as well as groundwater.

Conflicts Between Users:

None documented. There is only one user in this instance.

Quantity Concerns (type, source, level of concern):

The UMA report concludes that 13 wells would be required to supply Fort St. John based on the 20 L/s flow from one test production well that was only 22% efficient. If the efficiency were improved much fewer wells would be required. UMA also recommends a collector well design which may be unnecessary.

Quality Concerns (type, source, level of concern):

None documented. Based on 1993 water quality analyses from several testholes and the production well the groundwater is moderately mineralized (TDS = 370 mg/L), alkaline (total alkalinity = 220 mg/L) and hard water (hardness = 300 mg/L). Hardness in groundwater is however, mainly an aesthetic concern.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Driscoll, Fletcher G., *Groundwater and Wells*, 2nd ed. 1986. Published by Johnson Division, St Paul, Minnesota 55112, 1089 pages.

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Irish, E. J. W. 1958. *Geological Survey of Canada Map 17* – 1958. Charlie Lake. Preliminary Series Sheet 94A. Scale 1:250,000.

Le Breton, E. G. July 7, 1978. *A Preliminary Study of Groundwater Resources in Fort St. John Region.* Groundwater Section. Water Investigations Branch, B.C. Ministry of Environment File 0183613-C.

Locher, J. April 16, 1993. Memorandum to Paul Kemp, UMA Engineering, regarding PFRA Groundwater Testing.

Lord, T. M. and A. J. Green. 1986. *Soils of the Fort St. John – Dawson Creek Area, B.C. Report No 42*. British Columbia Soil Survey. Land Research Centre Contribution No. 85-27 Research Branch, Agriculture Canada.

Mathews, W. H. 1978. *Quaternary Stratigraphy and Geomorphology of Charlie Lake* (94A) Map Area, British Columbia. Geological Survey of Canada Paper 76-20. Energy, Mines and Resources Canada with Map 1460A Surficial Geology, Charlie Lake Peace River District, British Columbia. Scale 1:250,000.

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Mathews, W. H. 1955. *Groundwater Possibilities of the Peace River Block*, British Columbia. B.C. Dept. of Mines Groundwater Paper No. 3.

Tradewell, E. April 3, 1979. City of Fort St. John Groundwater Availability. Memorandum to A. P. Kohut, Senior Geological Engineer, Groundwater Section, Water Investigations Branch. B.C. Ministry of Environment.

Thurber Engineering, June 1976. Lower Peace River, Sites C and E Hydroelectric Development Proposals, Environmental Resource Atlas, Report to B.C. Hydro and Power Authority.

UMA Engineering Ltd., August 1993. Groundwater Source Preliminary Investigation, Fort St. John, B.C.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: 3.5 Km West of Taylor – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0442

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II A **RANKING VALUE: 12**

***Classification Component*:**

Level of Development: Moderate level of development in relation to aquifer productivity.

Level of Vulnerability: High vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**3**
Vulnerability	**3**
Size:	**1**
Demand:	**2**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**12**

Statistical Analysis of Well Data for Aquifer 0442:

Total number of wells available for statistical analysis: **11**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	11	8	8	2	7
Maximum	77	24	64	240	23
Minimum	21	6	29	100	6
Average	55	17	56	170	12
Median	62	16	61	170	13
Geometric Mean	50	16	55	155	11

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0443

AQUIFER LOCATION: Taylor Town site north of Peace River – Peace River Land District.

NTS MAP SHEET: 94 A. 2

BCGS MAP SHEET: 094 A.017

CLASSIFICATION: III B **RANKING VALUE: 6**

Aquifer Size:

11 km^2.

Aquifer Boundaries:

This unconsolidated aquifer has been delineated on the basis of topography, surficial geology and only two test well records. (NTS file 094A/02-05).

Geologic Formation (overlying):

Recent alluvial fan and fluvial deposits (sands, gravels, and silts) and older glacio-lacustrine deposits (clay and silty sand).

Geologic Formation (aquifer):

The aquifer is a buried fluvial gravel deposit. The one test hole completed in the aquifer describes the deposit as gravel.

Confined/Unconfined:

The aquifer is well confined by clay and silty sand, in the north but may be exposed in the south (near Peace River).

Vulnerability:

Moderate. This is based on one test well record only and may change with additional information. The aquifer is confined at higher elevation but may be exposed near the Peace River. It is also known that Fort St. John shale outcrops at the Peace River shoreline so the aquifer and confining layer both "pinch out" toward the river. Hence the confining layer of 21.3 m (70 feet) thickness may be thinner or absent over part(s) of the aquifer.

Productivity:

Productivity is assumed to be moderate to high judging by aquifers with similar geologic characteristics. There is no water data available for this aquifer. Yields would be expected to be moderate to high based on the aquifer material and hydrogeologic setting. A similar, but smaller, fluvial deposit (3 km NW) provides for wells with up to 20 L/s yield.

Depth to Water Table:

No water data is available, however well water levels are expected to be close to and somewhat above river level. The two test wells (testholes) drilled were not completed with screens and were not pumped.

Direction of Groundwater Flow:

There is not enough data to determinate flow direction.

Recharge:

Water well could be recharged from direct infiltration of precipitation (rain and snow). Recharge from Peace River may occur also, in the western section of the aquifer that borders the river.

Domestic Well Density:

There are no domestic wells reported to be located within this aquifer.

Type of Water Use:

The one well (testhole) completed here was drilled for a 1979 exploration program carried out by Stanley Associates for the Village of Taylor.

Reliance on Source:

This aquifer is undeveloped.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

No water data available.

Quality Concerns (type, source, level of concern):

No water data available.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Groundwater NTS Files 09A/02-05 – Taylor/ Water Supply System, 1979.

Lower Peace River Sites C and E Hydroelectric Development Proposals, Environmental Resource Atlas, Thurber Assoc. 1976.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Taylor Town site North of Peace River. - Peace River Land District.

AQUIFER NUMBER: 0443

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III B **RANKING VALUE: 6**

Classification Component:

Level of Development: Low. This aquifer is not developed.

Level of Vulnerability: Moderate vulnerability to surface contamination introduced at ground surface is assumed.

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Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**2**
Demand:	**0**
Type of Use:	**0**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**6**

Statistical Analysis of Well Data for Aquifer 0443

Total number of wells available for statistical analysis: **1**

	Well Depth (ft.)	**Depth to Water (ft.)**	**Depth to Bedrock (ft.)**	**Reported Est. Well Yield (USgpm)**	**Est. Thickness of Confining Materials (ft.)**
Number of Wells	1	0	0	0	1
Maximum	115	N/A	N/A	N/A	70
Minimum	115	N/A	N/A	N/A	70
Average	N/A	N/A	N/A	N/A	N/A
Median	N/A	N/A	N/A	N/A	N/A
Geometric Mean	N/A	N/A	N/A	N/A	N/A

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 19, 2011

AQUIFER REFERENCE NUMBER: 0444

AQUIFER LOCATION: Vicinity of Fort St John and Charlie Lake – Peace River Land District.

NTS MAP SHEET: 93 A 02

BCGS MAP SHEET: 094 A.25 / 26 / 27

CLASSIFICATION: II B **RANKING VALUE: 12**

Aquifer Size:

The area is approximately 75.5 km^2.

Aquifer Boundaries:

This unconsolidated aquifer has been delineated on the basis of well development only. It overlies the bedrock aquifer 451 and the boundaries are difficult to establish because some wells receive water from both aquifers. It extends from the south-western side of Charlie Lake until a little creek named *Crawford Coulee*, its eastern boundary. The aquifer 444 is more an aquifer system and is not present in the whole area, forming a series of smaller aquifers, communicating through channels of hundreds meters wide.

Geologic Formation (overlying):

The area is largely covered by glacial deposits. The extreme north part as well as the southern part are covered by glacio-lacustrine deposits and a small area in the centre of the area is covered by fluvioglacial materials. These deposits are extensively overlaid by glacial fill. The southern part contains glacial fill dating from the penultimate interglaciation and the northern part contains glacial fill dating from the last interglaciation.

Glacial deposits consist of till and stony silty clay, locally including some lacustrine material. Glacio-lacustrine deposits consist of clay, silt, minor sand and shoreline gravel. Fluvioglacial deposits consist of gravel and sand. Valley fill is composed of gravel, sand, silt and clay (Yeager and Brown, 1978, Map 1460A).

Geologic Formation (aquifer):

The well log records report soils composed of sand, gravel, boulders and till. The elaboration of a cross-section from the well log records has highlighted the extensive presence of lenses of clay at every depth. This explains such a wide range of static water levels in the well log records. Several levels of aquifer occur in this area, but they all communicate.

Confined/Unconfined:

The aquifer is confined by clay, till and locally silt. The confining layer has two windows of vulnerability reported.

Vulnerability:

Moderate. The geometric mean depth to static water level is 11.9 m (39 feet). The range of thickness of the confining layer in the well records ranges from 0 to 161.5 m (0 to 530 feet). The geometric mean thickness of the confining layer is 8.8 m (29 ft) and the median thickness of the confining layer is 17.7 m (58 ft). The permeability of the overlying formation is low (clay and till). Two windows of vulnerability have been identified in the extent of the aquifer.

Productivity:

The productivity is moderate with yields ranging from 0.06 L/s (1 USgpm) to 5 L/s (80 USgpm). The median and geometric mean of yields are respectively 0.3 and 0.38 L/s (5 and 6 USgpm). In our opinion most wells could produce more water with a properly designed screen intake. Well WTN # 42283 is reported to produce 0.6 L/s (9 USgpm) with no drawdown which indicates the well may produce more water.

Depth to Water Table:

The geometric mean static water level is 11.9 m (39 ft). The median static water level is 12.8 m (42 ft) and the range of static water level is 3 to 36.6 m (10 to 120 ft).

Direction of Groundwater Flow:

There is not enough data to determine with certainly the flow direction. The topography shows the area sloping down 0.5% to the east.

Recharge:

The aquifer could be recharged by direct infiltration from Charlie Lake and by the precipitation.

Domestic Well Density:

The domestic well density is low, with 1 well for every 2.3 km^2.

Type of Water Use:

Most of the wells are reported as domestic, however, some of them show a commercial use.

Reliance on Source:

This aquifer overlay the bedrock aquifer 451. It is present underneath the northern part of the aquifer. The southern part of the aquifer 444 is close to the Peace River, that could be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

No quantity concerns are noted in the well records.

Quality Concerns (type, source, level of concern):

One well (064A.026.3.3.1 #18) reported a hard water as well as a high rate of iron.

Comments:

The geometric mean depth of water wells in the aquifer is 32.6 m (107 ft). The median depth of wells is 31.7 m (104 ft) and the range of well depths is from 15.2 to 167.6 m (17 to 550 ft).

The statistics quoted for this aquifer are based on a total of 32 water well records.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Yeager F.S. and Brown D.G. 1978. Map 1460A. *Surficial Geology of Charlie Lake, BC*. Geological Survey of Canada. NTS File 93 B.

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AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Vicinity of Fort St John and Charlie Lake – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0444

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 12**

Classification Component:

Level of Development: Moderate (moderate productivity and low demand).

Level of Vulnerability: Moderate (few windows of vulnerability reported in confining layer).

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	2
Area	3
Demand	1
Type of Use	3
Quantity	0
Quality	1
Total	**12**

Statistical Analysis of Well Data for Aquifer 0444

Total number of wells available for statistical analysis: **32**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	32	16	0	21	27
Maximum	550	120	N/A	80	530
Minimum	17	10	N/A	1	0
Average	137	52	N/A	11	84
Median	104	42	N/A	5	58
Geometric Mean	107	39	N/A	6	29

* The bedrock aquifer 451 is located underneath the aquifer 444. To find information about the bedrock depth in the extent of the aquifer 444 please refer to the worksheet *Aquifer 451*.

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

REFERENCE NUMBER: 0448

AQUIFER DESCRIPTIVE LOCATION: Clayhurst area from Alces River to the Alberta border – Peace River Land District.

NTS MAP SHEET: 094 A.01

BCGS MAP SHEET: 94 A 020 and 030

CLASSIFICATION: III C **RANKING VALUE: 11**

Aquifer Size:

90.1 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of well development geology and topography. The boundaries of this aquifer have been shown as solid in the west and south and as dashed (less certain) to the north at the limit of well development.

Geologic Formation (overlying):

Well records indicate clay, gravel, sand and glacial till (moraine deposits) overly the bedrock. According to Surficial Geology Map 1460 A (Mathews, 1978) the surficial material is described as a interglacial gravel overlain by sands, silts clays attributed to aggredation and ponding of Peace River by advancing Laurentide Ice Sheet which ultimately covered the sediments with till.

Geologic Formation (aquifer):

Bedrock is of upper Cretaceous Period, Smoky Group (Wapiti). The Wapiti Formation consists of sandstone, carbonaceous shale and conglomerate (McMechan, 1994). The Wapiti formation consists mostly of non-marine, thick-bedded sandstones, flaggy, shaly sandstones, shales, and clays (McLearn et al,). Well records describe the bedrock as sandstone, shale, coal, limestone and mudstone.

Confined/Unconfined:

The aquifer is confined by clay and till.

Vulnerability:

Low. Wells are completed in a bedrock aquifer that is confined from ground surface by clay and till. The thickness of confining material ranges between 2.4 and 42.7m (8 and 140 ft) thick. The median and geometric mean thickness of confining material has been determined as 19.8 and 17.7 m (65 and 58 ft) thick respectively. The average thickness of confining material has been determined as 22.2 m (73 ft).

Productivity:

Moderate. Estimated yields from 6 wells have been recorded. Reported well yields range between 0.25 and 3.15 L/s (4 and 50 USgpm).

Depth to Water Table:

Groundwater levels reported range from 18 m (60 ft) to 61m (200 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation toward Peace River or Alces River.

Recharge:

Water wells are likely recharged from infiltration of precipitation (rain and snow) at ground surface and hydraulic interaction with the overlying unconsolidated aquifer.

Domestic Well Density:

Low. There are only 12 reported wells located within this aquifer. There is approximately 1 well per 7.5 km^2.

Users/Level of Use:

Water well use reported is domestic.

Reliance on Source:

Well water is the only reported source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

Isolated. Two "wells" were called dry holes and 1 was abandoned. This implies significant supplies may not be attainable over portions of the aquifer.

Quality Concerns (type, source, level of concern):

One well reported a high soda content and one high iron in the well water.

Notes:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

McLearn, F.H., and E.D. Kindle, 1950. *Geology of Northeastern British Columbia*. Geological Survey of Canada. Memoir 259. Department of Mines and Technical Surveys.
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Irish, E. J. W. 1958. *Geological Survey of Canada Map 17* – 1958. Charlie Lake. Preliminary Series Sheet 94A. Scale 1:250,000.

Le Breton, E. G. July 7, 1978. *A Preliminary Study of Groundwater Resources in Fort St. John Region.* Groundwater Section. Water Investigations Branch, B.C. Ministry of Environment File 0183613-C.

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Lord, T. M. and A. J. Green. 1986. *Soils of the Fort St. John – Dawson Creek Area, B.C. Report No 42*. British Columbia Soil Survey. Land Research Centre Contribution No. 85-27 Research Branch, Agriculture Canada.

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Tradewell, E. April 3, 1979. City of Fort St. John Groundwater Availability. Memorandum to A. P. Kohut, Senior Geological Engineer, Groundwater Section, Water Investigations Branch. B.C. Ministry of Environment.

Thurber Engineering, June 1976. Lower Peace River, Sites C and E Hydroelectric Development Proposals, Environmental Resource Atlas, Report to B.C. Hydro and Power Authority.

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AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Clayhurst, Peace River Land District.

AQUIFER REFERENCE NUMBER: 0448

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 11**

Classification Component:

Level of Development: Light level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination introduced at ground surface.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**1**
Quantity Concerns:	**1**
Total:	**11**

Statistical Analysis of Well Data for Aquifer 0448

Total number of wells available for statistical analysis: **12**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	12	6	10	6	12
Maximum	480	200	165	50	140
Minimum	107	60	**60**	4	8
Average	239	135	114	15	73
Median	196	131	120	7	65
Geometric Mean	214	124	109	9	58

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER REFERENCE NUMBER: 0451

AQUIFER LOCATION: Between Fort St. John to the south and Blueberry creek to the north – Peace River Land District.

NTS MAP SHEET: 094A.

WELL LOCATION MAPS: Parts of BCGS Trim Maps - 094A.017, .018, .023, .026, .027, .028, .034, .035, .036, .037, .044, .047, .054, .057, .064, .065, .067, .075 and .076. All of BCGS Trim Maps - 094A.045, .046, .055, .056 and .066.

CLASSIFICATION: III C **RANKING VALUE: 12**

Aquifer Size:

Approx. 3286 km^2.

Aquifer Boundaries:

This bedrock aquifer system has been delineated on the basis of well development (643 wells), geographical features and bedrock geology (Callan, 1973, Stott, 1961, 1982). The boundaries of this aquifer have been shown as dashed because they are not easily defined and therefore less certain.

Geologic Formation (overlying):

Clay or sandy clay in the lowland areas and till in the upland areas. These surficial deposits result from periods of glaciation and deglaciation (Groundwater Section, 1983). Clay has been commonly described on well records as *heavy* and *brown or blue* with respect to color.

Layers of sand or gravel are occasionally reported between clay beds. Clay and clay with silt and sand layering have been reported to a maximum depth of 304.8 m (1000 ft).

Geologic Formation (aquifer):

Shale and sandstone of the Dunvegan formation, Upper Cretaceous Period of the Mesozoic Era. The Dunvegan formation consists mainly of fine-grained finely laminated and cross bedded sandstones. Coarse-grained sandstone and conglomerate as well as carbonaceous shale also occur within the formation (Stott, 1961).

Bedrock lithology is primarily described on well records as *sandstone and shale interbeds* while thick formations of clay are often described to exist between the sandstone and shale formations. The clay may be misinterpreted by the driller on some well records and is likely a *clay shale* or *mudstone*. The clay is also commonly described on well records as *heavy*. Shale is commonly described as layered (laminated) with clay interbeds. Conglomerate has *not* been reported on well records.

The Dunvegan formation is widely distributed and reported to be over 305 m (1000 ft) thick in the vicinity of Fort St. John (Stott, 1982). This thickness, however, appears to be anomalous for the Dunvegan formation and contradicts Callan's opinion (1973). Generally the Dunvegan formation thickness ranges between 152 and 183 m (500 and 600 ft) thick within the aquifer boundaries. The Dunvegan formation is essentially non-marine in origin (Callan, 1973).

A few deeper wells to the north could be completed within the underlying marine shales of the Fort St. John formation but the contact between these formations has not been specifically noted on well records. It is also possible that hydraulic continuity exists between the deeper Fort St. John and the overlying Dunvegan formation and these formations behave hydraulically as a *single* aquifer system.

All wells located in the vicinity of Fort. St. John and Charlie Lake are completed to a depth of less than 304.8 m (1000 ft). Majority of the wells are located within the Dunvegan formation according to Callan (1973). However, a small percentage hit the Fort St John formation. The marine shales of the underlying Fort St. John formation exist at a depth of approximately 152.4 m (500 ft).

Aquifer interpretation has been based on bedrock geology (Stott, 1961 and 1982) and review of bedrock lithologies from 643 well records. Although Callan (1973) has suggested that the Dunvegan beds are comprised of two aquifer zones (upper and lower), for the purpose of this Aquifer Mapping Project, the Dunvegan aquifer has been considered as a single aquifer system.

Callan (1973) has further suggested that infiltration of recharge likely contributes mainly to the upper Dunvegan formation and the low permeability shales beneath the upper aquifer likely inhibit further downward movement to recharge the sandstones at the lower aquifer. A depth / yield relationship is not, however, evident from well record lithology and many well records do report significant yields from fractures at depth.

Confined/Unconfined/Bedrock:

Bedrock of the Dunvegan formation.

Vulnerability:

Low. Wells are completed in a bedrock aquifer that is confined from ground surface by material described on well records as *clay or sandy clay*. The thickness of the confining material ranges between 0 (bedrock at ground surface) and 100.6 m (330 ft) thick. The median and geometric mean thickness of this confining material has been determined as 12.8 and 8.7 m (42 and 28.5 ft) respectively. The average thickness has been determined as 17.7 m (58 ft). The aquifer has a high degree of confinement and is generally confined by thick a really extensive low permeability sediments (i.e. clay). A few well records show bedrock exists at ground surface.

Productivity:

Moderate. Reported well yields range between 0.01 and 15.8 L/s (0.2 and 250 USgpm). Based on 508 reported estimated well yields, the median and geometric mean well yields have been determined as 0.5 L/s and 0.49 L/s (8 and 7.7 USgpm) while the average yield has been determined as 1.0 L/s (16 USgpm). The water-bearing location(s) has been noted on 437 or 68 percent of well records. All well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained can be unreliable.

Pumping test data are generally not available; however transmissivity and storage coefficients were calculated from the observation well (MWLAP Observation Well 124) at Charlie Lake in 1971 by Callan (1973). The observation well is located 24.4 m (80 ft) from Charlie Lake. In 1971 the observation well was tested for a period of 24 hours at a constant rate of 0.57 L/s (9 USgpm). Callan determined a transmissivity of 243.4 m^2/day (19,600 USgpd/ft) from the drawdown data and 186.3 m^2/day (15,000 USgpd/ft) from the recovery data. A storage coefficient of 6×10^{-3} was determined from the drawdown data.

Depth to Water Table:

Groundwater levels are moderately deep ranging between 1.2 and 121.6 m (4 and 399 ft). Based on 437 reported water levels, the median and geometric mean groundwater levels have been determined as 22.0 and 20.5 m (72 and 67.3 ft) while the average groundwater level has been determined as 21.5 m (87 ft).

Although these calculations suggest that the water table is moderately deep, because 144 well records or 33 percent of reported water levels show the water level to be 30.5 m (100 ft) deep or deeper, the water table has been designated as moderately deep. Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels do vary seasonally, this measurement is not intended to represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation. Ground elevation is lowest along the Beatton Valley where the river presently cuts into the underlying Fort. St. John formation marine shales.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Ministry of Water Land and Air Protection (MWLAP) Observation Well 124 hydrograph and cumulative precipitation departure curve, suggest that groundwater levels reflects cumulative precipitation patterns and thus precipitation is likely a major source of recharge.

Charlie Lake may also contribute recharge to the Dunvegan formation. Groundwater levels in wells located near Charlie Lake may also be in hydraulic continuity with Charlie Lake (i.e. MWLAP Observation Well 124).

Domestic Well Density:

Low. There is less than 1 domestic well / km^2 (0.21 well/km^2). The majority of wells are located in the vicinity of Fort St. John and Charlie Lake to the northwest. Based on domestic well density alone the demand would be light. Additional development (domestic wells) would be possible. All wells are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water well use reported is domestic although a few wells report water use as commercial.

Reliance on Source:

Well water is the only known source of water for domestic use. Charlie Lake has 6 active registered licenses to withdraw water for irrigation and commercial use only. There are no registered domestic licenses on record.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented - although several dry boreholes have been noted within the aquifer system. The dry boreholes are generally widely distributed and not clustered in one specific location suggesting local quantity concerns do not exist. It may be simply that the well was not drilled deep enough to encounter a productive water-bearing zone. The dry boreholes have been disregarded in the data base analyses.

Quality Concerns (type, source, level of concern):

Local water quality concerns. Groundwater has been reported on several well records as *highly mineralized and very hard*. For example, a specific conductance of 4054 mg/L and total hardness of 1350 mg/L has been reported from one well (094A.055.4.2.4. #1). The majority of water quality results are from field (hach) analysis. Some Laboratory analysis results are available (1981 Water Quality Check Program). Water quality results are generally older (pre. 1988).

Although hardness in water is mainly an aesthetic concern because of the unpleasant taste that a high concentration of calcium and other ions give to water, water with hardness greater than 200 mg/L is considered poor in most regions of the Province and water with hardness greater than 500 mg/L is normally considered unacceptable for domestic purposes.

The groundwaters can be described as mainly calcium and magnesium bicarbonate types with some calcium and magnesium sulfate and sodium bicarbonate types (Groundwater Section, 1983).

Comments:

The Aquifer boundaries were originally identified and delineated by MWLAP staff in June 2003. At that time the aquifer was designated IIC (moderately developed with a low vulnerability) with an aquifer importance / priority ranking of 11. In July 2004, *Lowen Hydrogeology Consulting(LHC)* were hired under Contract (MWLAP Contract #1070-20/WAC/05/039) to review all hydrogeological data within the boundaries of this aquifer and make changes where considered applicable. Again in 2010 LHC was contracted by Geoscience BC to revise the Peace River Aquifers with data from new well records submitted since 2004.

Upon review, aquifer boundaries have been moved over 5 km westward and slightly changed along the eastern and southern boundaries. The aquifer has now been designated IIIC (lightly developed with a low vulnerability) with an aquifer importance / priority ranking of 12.

Although the majority of domestic wells are located in the vicinity of Fort St. John and Charlie Lake the entire aquifer has been considered when determining the level of development. The aquifer has therefore been designated as *lightly* developed (III) rather than *moderately* developed (II). The level of development compares the amount of water withdrawn from an aquifer (demand) to the aquifer's inferred ability to supply groundwater for use (productivity).

There are also no documented reports of pumping interference between water levels in wells closely spaced (Fort St. John / Charlie Lake area).

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Callan, D.M., 1973. *Reconnaissance Hydrogeology of Bedrock Aquifers in the Fort St. John Area (NTS 94A/6 and 94A/7).* Groundwater Division, Water Investigation Branch.

Groundwater Section, 1983. *Preliminary Assessment of Groundwater Prospects for the Peace River Strategic Plan*. Groundwater Section, Water Management Branch, Ministry of Environment. File 094A/01.

Stott, D.F., 1961. Paper 61-10. *Dawson Creek Map-Area, British Columbia 93P* Department of Mines and Technical Surveys. Geological Survey of Canada. NTS File 93 P.

Stott, D.F., 1982. Bulletin 328. *Lower Cretaceous Fort St. John Group and Upper Cretaceous Dunvegan Formation of the Foothills and Plains of Alberta, British Columbia, District of Mackenzie and Yukon Territory*. Geological Survey of Canada.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Between Fort St. John to the south and Blueberry creek to the north – Peace River Land District.

AQUIFER NUMBER: 0451

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 12**

Classification Component:

Level of Development: Low. Low level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to contamination introduced at ground surface.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**2**
Quantity Concerns:	**0**
Total:	**12**

Statistical Analysis of Well Data for Aquifer 0451:

Total number of wells available for statistical analysis: **643**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	642	437	606	508	595
Maximum	1000	399	1000	250	330
Minimum	28	4	0	0	0
Average	173	87	63	16	58
Median	133	72	45	8	42
Geometric Mean	138.5	67.3	33.4	7.7	28.5

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

REFERENCE NUMBER: 0589

AQUIFER LOCATION: East of Pine River

DESCRIPTIVE LOCATION: Bedrock area east of the confluence of the Pine River and the Murray River.

NTS MAP SHEETS: 093P/11, 093P/14

BCGS MAP SHEETS: 093P.074, 093P.075

CLASSIFICATION: II C **RANKING VALUE: 7**

Aquifer Size:

Area of aquifer is approximately 19 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of well development) and bedrock geology maps. The northern and southern boundaries of the aquifer were inferred due to a lack of hydrogeological information north and south of Highway 97. The western boundary is the Pine and Murray Rivers and the eastern boundary is based on a geological formation boundary.

Geologic Formation (overlying):

Alluvial and glaciofluvial plain deposits adjacent to the Pine and Murray Rivers. Lacustrine plain deposits east of these river valleys. Alluvial deposits consist of silt, sand and gravel and include sediments laid down in riverbeds and flood plains. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin.

Geologic Formation (aquifer):

Sandstone and shale formation of the Dunvegan Formation, Upper Cretaceous Period of the Mesozoic Era.

Confined/Unconfined/Bedrock:

Bedrock

Vulnerability:

Low. The static water level for one well is 9.1m (30 feet). The range of thickness of the confining layer in the well records ranges from 5.5 to 25.3 m (18 to 83 feet). The geometric mean thickness of the confining layer is 15.8 m (52 feet) and the median thickness of the confining layer is 21.3m (70 feet). No windows of vulnerability are reported. The porosity and permeability of the sandstone/shale formation is likely low however water may move rapidly through the fracture system.

Productivity:

Low. The well yields reported in the well records range up to 0.5 L/s (8 USgpm). The geometric mean of reported well yields is 0.18 L/s (2.8 USgpm) and the median well yield is 0.3 L/s (4.8 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

One well record indicates a static water level value of 9.1m (30 feet). All other well records do not provide static water level data for comparison.

Direction of Flow:

Has not been determined but may flow westward towards the Pine River valley. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.26 wells/km^2.

Users/Level of Use:

Domestic. Reported for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in this aquifer is 62.3m (204.5 feet). The median depth of wells is 61.0 m (200 feet) and the range of well depths is from 33.5 to 103.6m (110 to 340 feet).

The statistics quoted for this aquifer are based on a maximum of 5 water well records.

Screens are not used in wells completed into the bedrock aquifer.

There is no indication that high capacity wells could be developed in this aquifer.

No wells in this aquifer reported yields of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

McMechan, M.E., 1994. *Geology and structure cross section, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1858A, scale 1:250,000. Ottawa, ON.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: East of Pine River

AQUIFER REFERENCE NUMBER: 0589

AQUIFER TYPE: Bedrock

CLASSIFICATION: II C **RANKING VALUE: 7**

Classification Component:

Level of Development: ***Moderate*** : low level of demand in relationship to low level of aquifer productivity.

Level of Vulnerability: ***Moderate*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**1**
Vulnerability	**1**
Size:	**2**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**7**

Statistical Analysis of Well Data for Aquifer 0589

Total number of wells available for statistical analysis: **5**

	Well Depth (ft.)	**Depth to Water (ft.)**	**Depth to Bedrock (ft.)**	**Reported Est. Well Yield (USgpm)**	**Est. Thickness of Confining Materials (ft.)**
Number of Wells	5	1	5	4	4
Maximum	340	30	83	8	83
Minimum	110	30	15	1	18
Average	218	N/A	55	5	60
Median	200	N/A	70	5	70
Geometric Mean	204	N/A	47	3	52

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER REFERENCE NUMBER: 0590

DESCRIPTIVE LOCATION: Groundbirch, BC (Peace River District)

NTS MAP SHEETS: 093P/10, 093P/11, 093P/14 and 093P/15

BCGS MAP SHEETS: 093P.075, 093P.076

CLASSIFICATION: III C **RANKING VALUE: 11**

Aquifer Size:

Area of aquifer is approximately 49.5 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of well development) and surficial geology maps. The northern, western and eastern boundaries of the aquifer were delineated based on water well record information and areas containing thick surficial deposits (generally greater than 3 m in thickness). The southern boundary extends to a tributary of Coldstream Creek.

Geologic Formation (overlying):

Eolian ridged linear hills in the western portion of the aquifer overlay morainal deposits. Lacustrine plain deposits are found in the eastern portion of the aquifer. Eolian deposits consist of sands and silts transported by wind action. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin.

Geologic Formation (aquifer):

Glacio-fluvial deposits of poorly sorted sand gravel and silt.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 15 m (49.4 feet). The range of thickness of the confining layer in the well records ranges from 0 to 60.6 m (0 to 199 feet). The geometric mean thickness of the confining layer is 15.4 m (50.4 feet) and the median thickness of the confining layer is 28.6 m (94 feet). The permeability of the overlaying clay formation is low and was identified in all water well records except two.

Productivity:

Moderate. The well yields reported in the well records range up to 3.8 L/s (60 USgpm). The geometric mean of reported well yields is 0.58 L/s (9.2 USgpm) and the median well yield is 0.73 L/s (11.5 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 15 m (49.4 feet). The median static water level is 25.3 m (83 feet) and the range of static water level is 2.4 to 30.5 m (8 to 100 feet).

Direction of Flow:

Has not been determined. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.4 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

Isolated reports of water not used for drinking purposes. Very hard, high iron reported on a few well records.

Notes:

The geometric mean depth of water wells in this aquifer is 46 m (150.7 feet). The median depth of wells is 48.8m (160 feet) and the range of well depths is from 21.9 to 66.8 m (72 to 219 feet).

The statistics quoted for this aquifer are based on a maximum 21 water well records.

Screens are not reported in several wells and some wells indicate siltation, resulting in the wells being hydraulically inefficient.

It is probable that some high capacity wells could be developed in this aquifer.

Three wells in this aquifer reported yields of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South Groundbirch

AQUIFER REFERENCE NUMBER: 0590

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 11**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**11**

Statistical Analysis of Well Data for Aquifer 0590

Total number of wells available for statistical analysis**: 21**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	21	11	0	12	19
Maximum	219	100	N/A	60	199
Minimum	72	8	N/A	1	0
Average	155	66	N/A	16	105
Median	160	83	N/A	12	94
Geometric Mean	151	49	N/A	9	50

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0591

DESCRIPTIVE LOCATION: Groundbirch, Willow Valley, Sunset Prairie and Progress, BC.

NTS MAP SHEETS: 093P/10, 093P/11, 093P/14 and 093P/15

BCGS MAP SHEETS: 093P.075, 093P.076, 093P.077, 093P.085, 093P.086, 093P.087

CLASSIFICATION: III C **RANKING VALUE: 12**

Aquifer Size:

Area of aquifer is approximately 520 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and bedrock geology maps. The northern and western boundaries of the aquifer are based on a geological formation boundary. The southern boundary of the aquifer was inferred based on area of development. The eastern boundary is the Kiskatinaw River.

Geologic Formation (overlying):

Mixture of lacustrine, eolian, and morainal deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin. Eolian deposits consist of sands and silts transported by wind action. Morainal deposits consist of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Shale with some sandstone formations of the Kaskapau Formation, Smoky Group, Upper Cretaceous Period of the Mesozoic Era.

Confined/Unconfined/Bedrock:

Bedrock

Vulnerability:

Low. The mean depth to static water level is 15.2 m (50 feet). The range of thickness of the confining layer in the well records ranges from 0 to 89.9 m (0 to 295 feet). The geometric mean thickness of the confining layer is 15.2 m (50 feet) and the median thickness of the confining layer is 18.3 m (60 feet). The porosity and permeability of the shale formation is likely low however water may move rapidly through the fracture system.

Productivity:

Moderate. The well yields reported in the well records range up to 3.15 L/s (50 USgpm). The geometric mean of reported well yields is 0.35 L/s (5.6 USgpm) and the median well yield is 0.41 L/s (6.5 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 15.2 m (50 feet). The median static water level is 22.6 m (74 feet) and the range of static water level is 0.6 to 45.7 m (2 to 150 feet).

Direction of Flow:

Has not been determined. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.19 wells/km^2.

Users/Level of Use:

Domestic Agricultural, and Industrial. Reported for domestic use, livestock purposes and a gas plant.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

Isolated cases of dry wells reported on water well records and low or declining production.

Quality Concerns (type, source, level of concern):

Isolated cases of poor water quality. Wells used for livestock but not drinking water. High iron, hard water.

Notes:

The geometric mean depth of water wells in this aquifer is 58.8 m (193 feet). The median depth of wells is 61 m (200 feet) and the range of well depths is from 8.2 to 182.9 m (27 to 600 feet).

The statistics quoted for this aquifer are based on a total of 99 water well records.

Screens are not used in wells completed into the bedrock aquifer.

There is a slight potential that a high capacity well could be developed in this aquifer. One high capacity well was reported. However, no long term pumping tests have been conducted on this high capacity well to confirm the initial production estimates.

One well in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

Four wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

McMechan, M.E., 1994. *Geology and structure cross section, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1858A, scale 1:250,000. Ottawa, ON.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Groundbirch Bedrock

AQUIFER REFERENCE NUMBER: 0591

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 12**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**1**
Quantity Concerns:	**1**
Total:	**12**

Statistical Analysis of Well Data for Aquifer 0591

Total number of wells available for statistical analysis: **99**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	99	54	85	76	86
Maximum	600	150	317	50	295
Minimum	27	2	4	0	0
Average	225	68	111	11	86
Median	200	74	100	7	60
Geometric Mean	193	50	74	6	50

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER REFERENCE NUMBER: 0592

DESCRIPTIVE LOCATION: Groundbirch and Willow Valley, BC.

NTS MAP SHEETS: 093P/15

BCGS MAP SHEETS: 093P.076, 093P.085, 093P.086

CLASSIFICATION: III C **RANKING VALUE: 11**

Aquifer Size:

Area of aquifer is approximately 63.86 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and surficial geology maps. The eastern and southern boundaries of the aquifer are based on a change of geological formation. The surficial sediments are thin to the east and south of the aquifer and this is verified by information on bedrock wells in the vicinity. Therefore the aquifer boundary was defined as the boundary change between the ridged morainal deposits and the lacustrine veneer. The western boundary of the aquifer was inferred based on area of development. The northern boundary is Sunset Creek.

Geologic Formation (overlying):

Morainal deposits of the Cordilleran 'Classical' Wisconsin glacial deposits. A heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Glacio-fluvial deposits of poorly sorted sand, gravel and silt.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 5.2 m (17 feet). The range of thickness of the confining layer in the well records ranges from 0 to 38.1 m (0 to 125 feet). The geometric mean thickness of the confining layer is 4.0 m (13 feet) and the median thickness of the confining layer is 13.4 m (44 feet). The porosity of the overlaying clay formation is low and was identified in all water well records.

Productivity:

Moderate. The well yields reported in the well records range up to 2.52 L/s (40 USgpm). The geometric mean of reported well yields is 0.63 L/s (10 USgpm) and the median well yield is 0.57 L/s (9 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 5.2 m (17 feet). The median static water level is 6.1 m (20 feet) and the range of static water level is 1.2 to 16.8m (4 to 55 feet).

Direction of Flow:

Has not been determined but may flow north towards the Sunset Creek. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.34 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

Isolated cases of poor water quality. Wells used for livestock but not drinking water. High iron, hard water.

Notes:

The geometric mean depth of water wells in this aquifer is 22.6 m (74 feet). The median depth of wells is 22.9 m (75 feet) and the range of well depths is from 8.5 to 53.3m (28 to 175 feet).

The statistics quoted for this aquifer are based on a total of 22 water well records.

Screens are not reported in several wells and some wells indicate siltation resulting in the wells being hydraulically inefficient.

There is a slight possibility that a high capacity well could be developed in this aquifer. There are currently no reported high capacity wells in this aquifer.

No wells in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

Two wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Willow Valley

AQUIFER REFERENCE NUMBER: 0592

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 11**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**1**
Total:	**11**

Statistical Analysis of Well Data to Aquifer 0592

Total number of wells for statistical analysis: **22**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	21	17	2	12	18
Maximum	175	55	120	40	125
Minimum	28	4	65	5	0
Average	87	22	93	13	48
Median	75	20	93	9	44
Geometric Mean	74	17	88	10	13

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0593

DESCRIPTIVE LOCATION: Bear Mountain; Dawson Creek, Arras, (Peace River District, BC)

NTS MAP SHEETS: 093P/9

BCGS MAP SHEETS: 093P.068, 093P.069, 093P.070, 093P.078, 093P.079, 093P.080

CLASSIFICATION: III C **RANKING VALUE: 9**

Aquifer Size:

Area of aquifer is approximately 1146.86 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development), topographic features, significant valleys and bedrock geology maps. The western and part of the northern boundary is defined by the Kiskatinaw River and the eastern boundary by the Pouce Coupe River and the Alberta border. The remaining boundary segments are based on topography and well development.

Geologic Formation (overlying):

Lacustrine veneer. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin and generally less than 3m in thickness. The lacustrine veneer overlies Continental 'Classical' Wisconsin morainal glacial deposits consisting of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Shale with some sandstone formations of the Kaskapau Formation, Smoky Group, Upper Cretaceous Period of the Mesozoic Era. Higher elevations consist of the Cardium Formation which is a predominantly sandstone formation of the Smoky Group, Upper Cretaceous Period of the Mesozoic Era. The Cardium Formation is younger and likely overlays the shale Kaskapau Formation.

Confined/Unconfined/Bedrock:

Bedrock

Vulnerability:

Low. The geometric mean depth to static water level is 18 m (59 feet). The range of thickness of the confining layer in the well records ranges from 0 to 79.2 m (0 to 260 feet). The geometric mean thickness of the confining layer is 13.7 m (45 feet) and the median thickness of the confining layer is 17.4 m (57 feet). The porosity and permeability of the shale and sandstone formation is likely low however water may move rapidly through the fracture system.

Productivity:

Moderate. The well yields reported in the well records range up to 3.15 L/s (50 USgpm). The geometric mean of reported well yields is 0.32 L/s (5 USgpm) and the median well yield is 0.32 L/s (5 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 18 m (59 feet). The median static water level is 24.1 m (79 feet) and the range of static water level is 0.3 to 97.8 m (1 to 321 feet).

Direction of Flow:

Has not been determined but may flow radially (i.e. north towards South Dawson Creek, south and east towards Bissette Creek and west towards Kiskatinaw River). Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.05 wells/km^2, or one well per 18 km^2.

Users/Level of Use:

Domestic. Reported for domestic use only.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in this aquifer is 53 m (174 feet). The median depth of wells is 51.8 m (170 feet) and the range of well depths is from 9.7 to 824.5 m (32 to 2705 feet).

The statistics quoted for this aquifer are based on a total of 63 water well records.

Screens are not used in wells completed into the bedrock aquifer.

It is unlikely that many high capacity wells could be developed in this aquifer.

No wells in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing however there are some flowing springs reported in the eastern area of the aquifer.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

McMechan, M.E., 1994. *Geology and structure cross section, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1858A, scale 1:250,000. Ottawa, ON.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Bear Mountain; Dawson Creek, Arras, (Peace River District, BC)

AQUIFER REFERENCE NUMBER: 0593

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 9**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0593

Total number of wells available for statistical analysis: **63**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	61	34	43	36	58
Maximum	2705	321	325	50	260
Minimum	32	1	4	0	0
Average	280	88	92	9	76
Median	170	79	68	5	57
Geometric Mean	174	59	62	5	45

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0594

DESCRIPTIVE LOCATION: Groundbirch, Sunset Prairie, Progress, BC.

NTS MAP SHEETS: 093P/15

BCGS MAP SHEETS: 093P.076, 093P.077, 093P.087

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 53.77 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development), seismic and test drilling reports and geological reports on buried, pre-glacial, outwash channels. The inferred limits of the buried channels were determined from the availability of water well information. The geologic reports indicate that the buried channels may extend beyond these inferred boundaries.

Geologic Formation (overlying):

Mixture of lacustrine, alluvial, and morainal deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin. Alluvial deposits consist of silt, sand and gravel and include sediments laid down in riverbeds and flood plains. Morainal deposits consist of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Pre-Laurentide Glacial Period buried channel. Pre-late Wisconsinian sediments consisting of coarse sands and cobbley sands, with lesser amounts of pebble and cobble gravels. Alternating sand and gravel units. Sandy units comprise approximately two thirds of the strata. Silt is present in small quantities. This aquifer may not be encountered throughout the buried channels.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 27.7 m (91 feet). The range of thickness of the confining layer in the well records ranges from 0 to 83.2 m (0 to 273 feet). The geometric mean thickness of the confining layer is 18.6 m (61 feet) and the median thickness of the confining layer is 34.7 m (114 feet). Low permeable overlying clay was identified in all water well records.

Productivity:

Moderate. The well yields reported in the well records range up to 1.26 L/s (20 USgpm). The geometric mean of reported well yields is 0.57 L/s (9 USgpm) and the median well yield is 0.63 L/s (10 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 27.7 m (91 feet). The median static water level is 28 m (92 feet) and the range of static water level is 12.2 to 54 m (40 to 177 feet).

Direction of Flow:

The aquifer sediments were deposited in a buried channel flowing generally towards the northeast. Groundwater flow may follow this original drainage pattern, however further studies are required to verify the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.24 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in this aquifer is 93.9 m (308 feet). The median depth of wells is 80.8 m (265 feet) and the range of well depths is from 57.6 m to 207.3 m (189 to 680 feet).

The statistics quoted for this aquifer are based on a maximum of 13 water well records.

Screens are not reported in several wells and some wells indicate siltation resulting in the wells being hydraulically inefficient.

There is the possibility that a few high capacity wells could be developed in this aquifer. There are currently no reported high capacity wells in this aquifer.

No wells in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Callan, D.M., 1969. *Notes On A Subsurface Investigation of Four Townships in the Groundbirch Area of Northeastern British Columbia.* Groundwater Division. BC Ministry of Water, Land and Air Protection NTS File No. 38000-40/093P/15-03. Victoria, BC.

Callan, D.M., 1970. *An Investigation of Buried Channel Deposits in the Groundbirch Area of Northeastern British Columbia.* Report No. 3 of 1969 Peace River Rotary Drilling Program. Groundwater Division. BC Ministry of Water, Land and Air Protection NTS File No. 38000-40/093P/15-04. Victoria, BC.

Catto, N.R. *Quaternary Geology and Landforms of the Peace River Region, Northeastern British Columbia: Implications for Water Supply.* Department of Geography Memorial University of Newfoundland, St. John's NF. 50 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Groundbirch Sunset Prairie Buried Channel

AQUIFER REFERENCE NUMBER: 0594

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 10**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0594

Total number of wells available for statistical analysis: **13**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	13	8	2	6	12
Maximum	680	177	660	20	273
Minimum	189	40	526	4	0
Average	333	103	593	12	120
Median	265	92	593	10	114
Geometric Mean	308	91	589	9	61

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0595

DESCRIPTIVE LOCATION OF AQUIFER: Willow Valley, Sunset Prairie, BC.

NTS MAP SHEETS: 093P/15

BCGS MAP SHEETS: 093P.086, 093P.087, 093P.096

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 69.64 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and bedrock geology maps. The northern and southern boundaries of the aquifer are based on a geological formation boundary. The eastern boundary is the Kiskatinaw River. The western boundary is inferred based on area of development. The geological formation continues westward and the aquifer probably extends to the Pine River. The eastern boundary is the Kiskatinaw River.

Geologic Formation (overlying):

Mixture of lacustrine and morainal deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin. Morainal deposits consist of Cordilleran 'Classical' Wisconsin glacial deposits, which are comprised of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Sandstone and shale formation of the Dunvegan Formation, Upper Cretaceous Period of the Mesozoic Era.

Confined/Unconfined/Bedrock:

Bedrock

Vulnerability:

Low. The geometric mean depth to static water level is 13.4 m (44 feet). The range of thickness of the confining layer in the well records ranges from 1.2 to 73.2m (4 to 240 feet). The geometric mean thickness of the confining layer is 14.9 m (49 feet) and the median thickness of the confining layer is 15.8 m (52 feet). The porosity and permeability of the sandstone formation is likely low however water may move rapidly through the fracture system.

Productivity:

Moderate. The well yields reported in the well records range up to 1.45 L/s (23 USgpm). The geometric mean of reported well yields is 0.44 L/s (7 USgpm) and the median well yield is 0.44 L/s (7 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 13.4 m (44 ft). The median static water level is 11 m (36 ft) and the range of static water level is 8.2 to 25.9 m (27 to 85 ft).

Direction of Flow:

Has not been determined. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.2 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None Reported.

Quality Concerns (type, source, level of concern):

None reported.

Notes:

The geometric mean depth of water wells in this aquifer is 47.8 m (157 ft). The median depth of wells is 45.7 m (150 ft) and the range of well depths is from 22.2 to 128.0 m (73 to 420 ft).

The statistics quoted for this aquifer are based on 15 water well records.

Screens are not used in wells completed into the bedrock aquifer.

It is not probable that high capacity wells could be developed in this aquifer.

No wells in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

McMechan, M.E., 1994. *Geology and structure cross section, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1858A, scale 1:250,000. Ottawa, ON.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Bedrock North of Sunset Creek

AQUIFER REFERENCE NUMBER: 0595

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C	**RANKING VALUE: 10**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination introduced at ground surface.

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0595

Total number of wells available for statistical analysis: **15**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	15	7	11	13	14
Maximum	420	85	240	23	240
Minimum	73	27	**15**	1	4
Average	178	48	70	9	75
Median	150	36	45	7	52
Geometric Mean	157	44	52	7	49

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0596

DESCRIPTIVE LOCATION: Progress, Sunset Prairie, South Peace River District, BC.

NTS MAP SHEETS: 093P/10, 093P/15

BCGS MAP SHEETS: 093P.077, 093P.078, 093P.093P.086, 093P.087

CLASSIFICATION: III C **RANKING VALUE: 14**

Aquifer Size:

Area of aquifer is approximately 125.6 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and surficial geology maps. The northern and western boundaries of the aquifer were delineated based on areas containing thick surficial deposits (generally greater than 3 m in thickness) and water well record information. The eastern boundary is the Kiskatinaw River. The southern boundaries extend up the valleys of Fox, Livingstone and Tremblay Creeks. Here is a topographic high just south of Tremblay Creek (used as the southern border of the aquifer). This aquifer, or another aquifer of similar geologic origin may exist further south.

Geologic Formation (overlying):

Lacustrine plain deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin.

Geologic Formation (aquifer):

Glacio-fluvial deposits of poorly sorted sand, gravel and silt. Aquifer materials likely consist of beach or deltaic deposits from a Laurentide Glacial Period lake.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 13.7 m (45 feet). The range of thickness of the confining layer in the well records ranges from 5.8 to 42.1m (19 to 138 feet). The geometric mean thickness of the confining layer is 16.4 m (54 feet) and the median thickness of the confining layer is 15.2 m (50 feet). The permeability of the overlaying clay formation is low and was identified in all water well records.

Productivity:

Moderate. The well yields reported in the well records range up to 4.73 L/s (75 USgpm). The geometric mean of reported well yields is 0.88 L/s (14 USgpm) and the median well yield is 0.57 L/s (9 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 13.7 m (45 feet). The median static water level is 17.7 m (58 feet) and the range of static water level is 0.6 to 3.3 m (11 to 120 feet).

Direction of Flow:

Has not been determined. Further studies are required to determine the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.13 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

Several wells have silted in and become dry or have become less productive.

Quality Concerns (type, source, level of concern):

Several reports of water not used for drinking purposes as it results in illness. Very hard, high iron reported on several water well records.

Notes:

The geometric mean depth of water wells in this aquifer is 21 m (69 ft). The median depth of wells is 17.7 m (58 ft) and the range of well depths is from 6.7to 65.5 m (22 to 215 ft).

The statistics quoted for this aquifer are based on a total of 16 water well records.

Screens are not reported in several wells and several wells indicate siltation resulting in the wells being hydraulically inefficient.

It is unlikely that high capacity wells could easily be developed in this aquifer.

One well in this aquifer reported yield of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Progress, Sunset Prairie

AQUIFER REFERENCE NUMBER: 0596

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 14**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**2**
Quantity Concerns:	**2**
Total:	**14**

Statistical Analysis of Well Data for Aquifer 0596

Total number of wells available for statistical analysis: **16**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	16	10	1	5	15
Maximum	215	120	41	75	138
Minimum	22	11	41	5	19
Average	96	63	N/A	23	68
Median	58	58	N/A	9	50
Geometric Mean	69	45	N/A	14	54

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

REFERENCE NUMBER: 0597

DESCRIPTIVE LOCATION: Arras, Dawson Creek, South Peace River District, BC.

NTS MAP SHEETS: 093P/09, 093P/10, 093P/15, 093P/16

BCGS MAP SHEETS: 093P.067, 093P.077, 093P.078

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 40.5 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development), seismic and test drilling reports and geological reports on buried, pre-glacial, outwash channels. The inferred limits of the buried channels were determined from the availability of water well information. The geologic reports indicate that the buried channels may extend beyond these inferred boundaries.

Geologic Formation (overlying):

Mixture of lacustrine, alluvial, and morainal deposits. Lacustrine deposits consist of clay, silt and sand deposited in a standing body of water; largely fluviatile and/or glacial in origin. Alluvial deposits consist of silt, sand and gravel and include sediments laid down in riverbeds and flood plains. Morainal deposits consist of a heterogeneous assortment of clay to boulder size material deposited directly from glacial ice.

Geologic Formation (aquifer):

Pre-Laurentide Glacial Period buried drainage channel. Pre-late Wisconsinian sediments consisting of coarse sands and cobbley sands, with lesser amounts of pebble and cobble gravels. Alternating sand and gravel units. Sandy units comprise approximately two thirds of the strata. Silt is present in small quantities.

Confined/Unconfined/Bedrock:

Confined

Vulnerability:

Low. The geometric mean depth to static water level is 16.4 m (54 feet). The range of thickness of the confining layer in the well records ranges from 44.2 to 134.1m (145 to 440 feet). The geometric mean thickness of the confining layer is 81.7 m (268 feet) and the median thickness of the confining layer is 92 m (302 feet). The permeability of the overlaying clay formation is low and was identified in all water well records.

Productivity:

Moderate. The well yields reported in the well records range up to 4.73 L/s (75 USgpm). The geometric mean of reported well yields is 2.02 L/s (32 USgpm) and the median well yield is 1.58 L/s (25 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 16.4 m (54 ft). The median static water level is 22.9 m (75 ft.) and the range of static water level is 4.6 to 42.7 m (15 to 140 ft).

Direction of Flow:

The aquifer sediments were deposited by a channel flowing towards the east. Groundwater flow may follow the original drainage pattern, however, further studies are required to verify the direction of flow.

Recharge:

Precipitation. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 0.1 wells/km^2.

Users/Level of Use:

Domestic and Agricultural. Reported for domestic use and livestock purposes.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in this aquifer is 115.8 m (380 ft). The median depth of wells is 114 m (374 ft.) and the range of well depths is from 98.8 to 140.2 m (324 to 460 ft).

The statistics quoted for this aquifer are based on a total of 4 water well records. Statistics are not representative of the aquifer as a whole and additional drilling into this aquifer will alter the reported aquifer characteristic values.

Productivity was based on two water well records including one high capacity well. Statistics are not representative of the aquifer as a whole and productivity of the aquifer is rated as moderate rather than high until additional water wells are completed into this aquifer.

There is the possibility that a few high capacity wells could be developed in this aquifer.

One water well in this aquifer reported a yield of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Callan, D.M., 1969. *Notes On A Subsurface Investigation of Four Townships in the Groundbirch Area of Northeastern British Columbia.* Groundwater Division. BC Ministry of Water, Land and Air Protection NTS File No. 38000-40/093P/15-03. Victoria, BC.

Callan, D.M., 1970. *An Investigation of Buried Channel Deposits in the Groundbirch Area of Northeastern British Columbia.* Report No. 3 of 1969 Peace River Rotary Drilling Program. Groundwater Division. BC Ministry of Water, Land and Air Protection NTS File No. 38000-40/093P/15-04. Victoria, BC.

Catto, N.R. *Quaternary Geology and Landforms of the Peace River Region, Northeastern British Columbia: Implications for Water Supply.* Department of Geography Memorial University of Newfoundland, St. John's NF. 50 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Arras Buried Channel

AQUIFER REFERENCE NUMBER: 0597

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 10**

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***Low*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0597

Total number of wells available for statistical analysis: **4**

	Well Depth (ft.)	**Depth to Water (ft.)**	**Depth to Bedrock (ft.)**	**Reported Est. Well Yield (USgpm)**	**Est. Thickness of Confining Materials (ft.)**
Number of Wells	4	3	1	3	3
Maximum	460	140	270	75	440
Minimum	324	15	270	18	145
Average	383	77	N/A	39	296
Median	374	75	N/A	25	302
Geometric Mean	380	54	N/A	32	268

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

REFERENCE NUMBER: 0598

DESCRIPTIVE LOCATION: Pouce Coupé, South Peace River District, BC.

NTS MAP SHEETS: 093P/16

BCGS MAP SHEETS: 093P.080

CLASSIFICATION: III A **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 3.15 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of development) and surficial geology maps. The aquifer boundaries are within the valley of the Pouce Coupé River.

Geologic Formation (overlying):

Alluvial deposits. Alluvial deposits consist of silt, sand and gravel and include sediments laid down in riverbeds and flood plains.

Geologic Formation (aquifer):

Recent fluvial deposits of sand, gravel and silt.

Confined/Unconfined/Bedrock:

Unconfined to Semi-confined (silt).

Vulnerability:

High. The high vulnerability is due to lack of silt over much of the aquifer. The geometric mean depth to static water level is 1.4 m (4.5 ft). One well record gives the thickness of the confining layer: 31.7 m (104ft). The permeability of sand and gravel is moderate to high and the porosity of sand and gravel is moderate. The permeability of the silt formation is low and the porosity of silt is moderate.

Productivity:

Moderate. Only one well record indicated a yield of 10.1 L/s (160 USgpm). The BC Ministry of Water, Land and Air Protection has no available pumping test data to estimate the transmissivity and specific capacity values.

Depth to Water Table:

The geometric mean static water level is 1.4 m. (4.5 ft.). The median static water level is 1.8 m (6 ft) and the range of static water level is 0.6 to 3.1 m (2 to 10 ft).

Direction of Flow:

Has not been determined. Further studies are required to determine the direction of flow.

Recharge:

Precipitation and surface water infiltration from the Pouce Coupé River. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density:

Low. Approximately 2 wells/km^2.

Users/Level of Use:

Domestic use. The village of Pouce Coupé once obtained municipal water from groundwater wells completed into the Pouce Coupé River aquifer. These wells are no longer in use and the community obtains municipal water supply from the City of Dawson Creek.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None reported.

Quality Concerns (type, source, level of concern):

None reported.

Notes:

The geometric mean depth of water wells in this aquifer is 13.4 m (44 ft). The median depth of wells is 18.9 m (62ft) and the range of well depths is from 3.7 to 45.1 m (12 to 148 ft).

The statistics quoted for this aquifer are based on a total of 6 water well records.

Productivity was based on one water well record and depth to water was based on two water well records. Statistics are not representative of the aquifer as a whole and productivity of the aquifer is rated as moderated until additional water wells are completed into this aquifer.

There is potential that a few high capacity well could be developed in this aquifer.

One well in this aquifer reported yields of greater than 3.15 L/s (50 USgpm).

No wells in this aquifer are reported to be flowing.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia.* Groundwater Section, Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, BC. File No. 00400-20. 68pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Pouce Coupé

AQUIFER REFERENCE NUMBER: 0598

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III A	RANKING VALUE: 10

Classification Component:

Level of Development: ***Low*** level of demand in relationship to moderate level of aquifer productivity.

Level of Vulnerability: ***High*** level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**3**
Vulnerability	**3**
Size:	**1**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0598

Total number of wells available for statistical analysis: **6**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	6	2	0	1	1
Maximum	148	10	N/A	160	104
Minimum	12	2	N/A	160	104
Average	74	6	N/A	N/A	N/A
Median	62	6	N/A	N/A	N/A
Geometric Mean	44	4	N/A	N/A	N/A

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

REFERENCE NUMBER: 0621

DESCRIPTIVE LOCATION: Kelly Lake – Southeast of Dawson Creek, Peace River Land District.

NTS MAP SHEET: Map: 093 P / 8.

BCGS MAP SHEET: 93 P 030

CLASSIFICATION: III B **RANKING VALUE: 10**

Aquifer Size:

27.50 km^2.

Aquifer Boundaries:

This small bedrock aquifer has been delineated on the basis of well development only. The boundaries of this aquifer have been shown as solid along the west shore of Kelly Lake and as dashed (less certain) where the boundary is in close proximity to the location of the wells. At present, there is insufficient information to extend the aquifer boundary further upslope.

Geologic Formation (overlying):

Well records indicate clay, and glacial till (moraine deposits) overly the bedrock. According to Surficial Geology Map 1467 A (Reimchen, 1971) the surficial material is described as a *heterogeneous assortment of clay to boulder size materials deposited directly from glacial ice*. The material is further described as hummocky: a term restricted to small, steep-sided hills that consist of unconsolidated material thick enough to mask the underlying structure of the bedrock.

Geologic Formation (aquifer):

Bedrock is of the Cenozoic Era. Upper Cretaceous Period. The Wapiti formation consists of sandstone, carbonaceous shale and conglomerate (McMechan, 1994). The Wapiti formation consists mostly of non-marine, thick-bedded sandstones, flaggy, shaly sandstones, shales, and clays (McLearn et al,). Well records simply describe the bedrock as *layered* sandstone.

Confined/Unconfined:

Locally confined by clay and till.

Vulnerability:

Moderate. Wells are completed in a bedrock aquifer that is locally confined from ground surface by clay and till. The thickness of confining material ranges between 9.1 and 16.8 m (30 and 55 ft) thick. The median and geometric mean thickness of confining material has been determined as 13.1 and 12.8 m (43 and 42 ft) thick respectively. The average thickness of confining material has been determined as 13.1 m (43 ft).
Pumping test data suggest Kelly Lake interacts with the local groundwater system and is a source of recharge at least to wells located close to the shoreline. As Kelly Lake was formed by glacial activity, the surrounding landscape and lakebed are underlain by fractured sandstone, allowing hydraulic communication between the lake and the bedrock aquifer.
Although the aquifer is confined by clay and till at surface, because of the interchange between surface water (Kelly Lake) and groundwater, the recharge water has likely not been in the flow system for long and likely enters and moves through the aquifer with considerable ease. The surface water (lake) can also be a source of potential contamination. For these reasons the vulnerability has been rated more conservatively as moderate (B) rather than low (C).

Productivity:

Moderate. Estimated yields from 2 wells have been recorded. Reported well yields range between 1.26 and 2.2 L/s (20 and 30 USgpm), however, 6-hour pump tests (attached) carried out on 2 of the 6 wells suggest these wells have greater long-term well capacities.

Depth to Water Table:

Groundwater levels reported are shallow ranging from 0.3 m (1 ft) to 8.8 m (29 ft). Groundwater levels likely become deeper upslope (to the southwest).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation toward Kelly Lake. Groundwater flow is generally toward the lake but well water abstraction near the lake can cause flow from the lake to the nearby wells.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface and hydraulic interaction with upland creeks, wetlands and Kelly Lake. Pumping test data suggests good hydraulic continuity exists between the lake and the bedrock aquifer near to the lake.

Domestic Well Density:

Low. There are only 6 reported wells located within this aquifer. There is approximately 1 well per 4.5 km^2. Three wells of interest have been reported on the spreadsheet, however inadequate locations have prevented these wells from being plotted. Information from these wells therefore has not been included within aquifer statistics.

Users/Level of Use:

Water well use reported is domestic.

Reliance on Source:

Well water is the only reported source of water for domestic use. Kelly Lake may also be a source of domestic water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

McLearn, F.H., and E.D. Kindle, 1950. *Geology of Northeastern British Columbia*. Geological Survey of Canada. Memoir 259. Department of Mines and Technical Surveys.

McMechan, M.E., 1994. Map 1858A. *Geology and Structure Cross-Section, Dawson Creek, BC.* Geological Survey of Canada. NTS File 93P.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Kelly Lake – southeast of Dawson Creek, Peace River Land District.

AQUIFER REFERENCE NUMBER: 0621

AQUIFER TYPE: Bedrock

CLASSIFICATION: III B **RANKING VALUE: 10**

***Classification Component*:**

Level of Development: Low level of development in relation to aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**2**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0621

Total number of wells available for statistical analysis: **6**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	6	5	6	2	6
Maximum	160	29	55	30	55
Minimum	56	1	35	20	30
Average	118	18	44	25	43
Median	120	27	43	25	43
Geometric Mean	111	11	43	24	42

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

REFERENCE NUMBER: 0622

DESCRIPTIVE LOCATION: South of Pouce Coupe, north of Tate Creek and west of Tupper River - Peace River Land District.

NTS MAP SHEET: NTS Map: 093 P 09

BCGS MAP SHEETS: 93 P. 50 /49/59/ 60 / 69 / 70 / 80

CLASSIFICATION: III C **RANKING VALUE: 12**

Aquifer Size:

280.16 km^2.

Aquifer Boundaries:

This large bedrock aquifer has been delineated on the basis of well development, topography, geographical features (i.e. Pouce Coupe River and Swan Lake) and bedrock type. The boundaries of this aquifer have been shown as solid along Pouce Coupe River/Swan Lake and as dashed (less certain) where the boundary is defined by topography and well development. There is a *low* degree of certainty regarding the aquifer boundary location.

Geologic Formation (overlying):

Well records indicate thick deposition of uniform clay and gumbo clay overlies the bedrock. Well records show a maximum thickness of clay and gumbo clay of 61 m (200 ft.). According to the Soil Map of the Peace River District (Farstad, et al, 1965) the clays were developed from glaciolacustrine (glacial lake sediments). Well records show an absence of glacial till.

Geologic Formation (aquifer):

Bedrock of Mesozoic Era, Upper Cretaceous Age. Dowling, Thistle and Hanson Members: dark grey shale, calcareous shale, siltstone; includes Muskiki Member northeast of mappable limit of Marshybank Sandstones (McMechan, 1994). Well records generally describe the bedrock as *layered* sandstone and shale. Because of the large size of this aquifer and the complex and wide variety of hydraulic responses that are likely exhibited within this bedrock, it is more appropriate to term this bedrock as an aquifer *System* rather than simply a bedrock aquifer.

Confined/Unconfined:

Highly confined (locally) by *clay and gumbo clay*.

Vulnerability:

Low. Wells are completed in a bedrock aquifer that is highly confined from ground surface by material described as *clay and gumbo clay* (saturated fine silty soil). The thickness of confining material ranges between 5.6 and 117.6 m (18 and 386 ft) thick. The median and geometric mean thickness of this confining material has been determined as 31.7 and 28 m (104 and 92 ft) thick respectively. The average thickness of confining material has been determined as 36 m (118 ft).

Productivity:

Moderate. Reported well yields range between 0.06 and 6.31 L/s (1 and 100 USgpm). The median and geometric mean well yields are 0.76 and 0.57 L/s (10 and 9 USgpm) while the average yield has been determined as 0.95 L/s (15 USgpm). Well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. No pumping test data are available.

Depth to Water Table:

Only a few groundwater levels were reported at the time of well construction. Groundwater levels reported are variable ranging between 1.2 and 89 m (4 and 292 ft), this wide range is due to well head elevation differences. Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There is less than 1 well / km^2 (0.14 well/km^2). All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water well use reported is domestic. A few well records report wells are used for stock and commercial purposes.

Reliance on Source:

Well water is the only known source of water for domestic and commercial use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

One well record reports (1965) a hardness of 731 mg/L (TDS not measured). Water quality field data is older (1965). The groundwater is highly mineralized (TDS reported to 3684 mg/L), very hard (hardness reported to 2000+ mg/L), alkaline (alkalinity up to 1020 mg/L). Some well records report that the groundwater is not suitable for domestic or irrigation use. One well record (092P.060.4.2.1. # 1) with 1981 laboratory analyses indicates TDS and specific conductance extremely low (10 mg/L and 22 µmhos/cm respectively) and is very questionable.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

McMechan, M.E., 1994. Map 1858A. *Geology and Structure Cross-Section, Dawson Creek, BC.* Geological Survey of Canada. NTS File 93P.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South of Pouce Coupe, River - Peace River Land District.

AQUIFER REFERENCE NUMBER: 0622

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 12**

Classification Component:

Level of Development: Low level of development. Low level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**2**
Quantity Concerns:	**0**
Total:	**12**

Statistical Analysis of Well Data for Aquifer 0622

Total number of wells available for statistical analysis: **39**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	39	17	37	31	35
Maximum	460	292	386	100	386
Minimum	90	4	18	1	18
Average	213	85	122	15	118
Median	194	40	118	10	104
Geometric Mean	198	45	96	9	92

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 24, 2011.

AQUIFER REFERENCE NUMBER: 0623

AQUIFER DESCRIPTIVE LOCATION: Lone Prairie

NTS MAP SHEET: 93 P 11

BCGS MAP SHEET: 93 P 53 / 54

CLASSIFICATION: II B	**RANKING VALUE: 10**

Aquifer Size:

17.86 km^2 .

Aquifer Boundaries:

The aquifer boundaries were delineated using the well log records. The boundary is not well defined and was drawn in order to encompass all the unconsolidated wells in the area.

Geologic Formation (overlying):

Two main overlying formations are noticeable. Lacustrine deposits cover most of the area and Eolian/Morainal deposits are located in the eastern part of the area. A small part of the aquifer stands in an alluvial fan occurring around a small creek (south of the area).
Lacustrine deposits consist of clay, silt, sand and minor gravel deposited in a standing body water. Eolian deposits are sand and silts transported by the action of the wind. Morainal deposits are a heterogeneous assortment of clay to boulder size material deposited from glacial ice.

Geologic Formation (aquifer):

The well log records report a water-bearing formation mostly composed of gravel and sand.

Confined/Unconfined:

Confined by low permeability clay.

Vulnerability:

Moderate. The thickness of the confining layer in the well records ranges from 1.5 to 134.1 m (5 to 440 ft). The geometric mean thickness and the median of the confining layer are respectively 11.6 and 10.5 m (38 and 34 ft). The permeability of the overlying formation is low (clay and silt).

Productivity:

Moderate. Reported well yields range between 0.19 and 2.21 L/s (3 and 35 USgpm). The median and geometric mean well yields are 0.57 L/s and 0.63 L/s (9 and 10 USgpm) while the average yield has been determined as 0.82 L/s (13 USgpm).

Depth to Water Table:

Groundwater levels reported are shallow to moderately shallow, ranging between 3 to 73m (10 to 240 ft). The geometric mean and the median are respectively 13.4 and 15.2 m (44 and 50 ft). The average depth to the water table is 26.2 m (86 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine.

Recharge:

Water wells are likely recharged from direct infiltration from the rivers and creeks. Precipitation is another source of recharge.

Domestic Well Density:

Low. There are 2.2 wells/km^2.

Type of Water Use:

Water use reported is domestic and *other*.

Reliance on Source:

Well water is the only known source of water for domestic use irrigation and stock use. The surrounding rivers and creeks may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

The geometric mean depth of water wells in the aquifer is 53.6 m (176 ft). The median depth of wells is 56.4 m (185 ft) and the range of well depths is from 19.8 to 150.9 m (65 to 495 ft).

The statistics quoted for this aquifer are based on a total of 8 water well records.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Lone Prairie

AQUIFER REFERENCE NUMBER: 0623

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 10**

***Classification Component*:**

Level of Development: Moderate (moderate productivity and low demand)

Level of Vulnerability: Moderate (Thin clay confining layer but no window of vulnerability)

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**2**
Size:	**2**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0623

Total number of wells available for statistical analysis: **8**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	8	5	0	5	4
Maximum	495	240	N/A	35	440
Minimum	65	10	N/A	3	5
Average	228	86	N/A	13	128
Median	185	50	N/A	10	34
Geometric Mean	176	44	N/A	9	38

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

AQUIFER REFERENCE NUMBER: 0624

AQUIFER DESCRIPTIVE LOCATION: Chetwynd area – Southeast of Groundbirch and adjacent to Wildmore Creek. Peace River Land District.

NTS MAP SHEET: 093 P / 12

BCGS MAP SHEETS: 093 P.062

CLASSIFICATION: II B **RANKING VALUE: 9**

Aquifer Size:

1.07 km^2.

Aquifer Boundaries:

This small unconsolidated aquifer has been delineated on the basis of well development (wells completed in the aquifer and bordering wells completed in bedrock), topography, and surficial geology (Reimchen, 1971). The boundaries of this aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

Well records show variability in both deposition and thickness of overlying clays.

Geologic Formation (aquifer):

Alluvial fan and glaciofluvial deposits (intermixed). Surficial geology is complex and *aquifer* also includes glaciofluvial deposits below the till. Post glacial fluvial action appears to have *reworked and / or removed* tills, glaciofluvial sands and gravels and glaciolacustrine sediments laid down earlier by Cordilleran Ice approximately 15,000 years ago. Well records show considerable variability in both *thickness and type* of deposition.

Confined/Unconfined/Bedrock:

Confined by *clay, silty clay and till.*

Vulnerability:

Moderate. Wells are completed in an unconsolidated aquifer that is confined from ground surface by material described as *clay, silty and / or sandy clay, and till.* Colluvial material (rubble) has been reported on a few well records. The thickness of confining material is variable ranging between 0 and 110 m. (0 and 360 ft.) thick. The median and geometric mean thickness of this confining material has been determined as 9.1 and 3 m (30 and 10 ft) thick respectively. The average thickness has been determined as 24.4 m (80 ft). Three wells of 11 suggest that the aquifer has *windows* of vulnerability.

Productivity:

Moderate. Reported well yields range between 0.19 and 1.89 L/s (3 and 30 USgpm). The median and geometric mean well yields are 1.26 L/s and 0.82 L/s (20 and 13 USgpm) while the average yield has been determined as 1.07 L/s (17 USgpm). A short-term (5 hour) pumping test appears to have been carried out on the screened well (093P.062.3.2.4. #4), however drawdown and recovery measurements were not obtained. The majority of well yields *reported* are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable.

Depth to Water Table:

Groundwater levels reported range between 3.6 and 30.5 m. (15 and 100 ft.). The median and geometric mean groundwater levels have been determined as 9.1 and 9.4 m (30 and 31 ft) while the average groundwater level has been determined as 11 m (36 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels do vary seasonally, this measurement is not intended to represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some wells located at lower elevation and close to Wildmore Creek may be in hydraulic continuity with Wildmore Creek.

Domestic Well Density:

Moderate. The calculated well density is 10.6 wells per km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

All water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although water quality concerns have not been specifically documented from wells located within this aquifer, water quality in surficial deposits throughout the Peace River District can be very hard, alkaline and highly mineralized.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Chetwynd area – Southwest of Chetwynd and adjacent to Wildmore Creek. Peace River Land District.

AQUIFER REFERENCE NUMBER: 0624

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate. Moderate level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**1**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0624

Total number of wells available for statistical analysis: **11**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	11	10	0	9	11
Maximum	383	100	N/A	30	360
Minimum	40	15	N/A	3	0
Average	117	36	N/A	17	80
Median	60	30	N/A	20	30
Geometric Mean	80	31	N/A	13	10

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER REFERENCE NUMBER: 0625

DESCRIPTIVE LOCATION: Chetwynd area – Southwest of Chetwynd and adjacent to Bissett Creek – Peace River Land District

NTS MAP SHEETS: 93 P 12

BCGS MAP SHEETS: 093 P.062

CLASSIFICATION: II B **RANKING VALUE: 9**

Aquifer Size:

0.92 km^2.

Aquifer Boundaries:

This small unconsolidated aquifer has been delineated on the basis of well development (wells completed in unconsolidated deposits and bordering wells completed in bedrock), topography, and surficial geology (Reimchen, 1971). The boundaries of this aquifer have been shown as dashed (less certain).

Unconsolidated/Bedrock:

Unconsolidated.

Geologic Formation (overlying):

Well records show clay and possible colluvial material (rubble) overlie the aquifer.

Geologic Formation (aquifer):

Alluvial fan with possible glaciofluvial deposits (intermixed).

Confined/Unconfined:

Confined by *clay and till* but with *windows* of vulnerability.

Vulnerability:

Moderate. Wells are completed in a small unconsolidated aquifer (alluvial fan) that is confined from ground surface by clay but with *windows* of vulnerability. Two well records located within this aquifer (093P.062.3.2.1. #6 and #7) reports gravel from surface. Possible *colluvial* material has also been reported on a few well records, which could be vulnerable to contamination from ground surface. Most well records report only the *presence* of clay and not the thickness of confining material (i.e. clay). One well record reports *glacial till* to a depth of 11 m (36 ft) from ground surface.

Productivity:

Moderate. Reported well yields range between 0.38 and 2.52 L/s (6 and 40 USgpm). The median and geometric mean well yields are 2.21 L/s and 1.26 L/s (35 and 20 USgpm) while the average yield has been determined as 1.64 L/s (26 USgpm). Well yields *reported* are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable.

Depth to Water Table:

Groundwater levels reported are generally shallow ranging between 3.0 and 12.2 m (10 and 40 ft). The median and geometric mean groundwater levels are 6.4 and 6.7 m (21 and 22 ft) respectively while the average depth to groundwater has been determined as 7.6 m (25 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation towards the Pine River floodplain.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some wells located at lower elevation and adjacent to may be in hydraulic continuity with Bissett Creek.

Domestic Well Density:

Moderate. The calculated well density is 8.7 wells per km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water well use reported is domestic. One well record reports the water use is for *Dokie School* located west of Chetwynd.

Reliance on Source:

Well water is the only known source of water for domestic use and commercial use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although water quality concerns have not been specifically documented from wells located within this aquifer, water quality in surficial deposits throughout the Peace River District can be very hard, alkaline and highly mineralized.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Chetwynd area – Southwest of Chetwynd and adjacent to Bissett Creek. Peace River Land District.

AQUIFER REFERENCE NUMBER: 0625

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B	**RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate. Moderate level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**1**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0625

Total number of wells available for statistical analysis: **8**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	8	6	0	5	6
Maximum	60	40	N/A	40	50
Minimum	24	10	N/A	6	0
Average	43	25	N/A	26	25
Median	40	21	N/A	35	31
Geometric Mean	41	22	N/A	20	5

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

AQUIFER REFERENCE NUMBER: 0626

DESCRIPTIVE LOCATION OF AQUIFER: Chetwynd area – North of Pine River. Peace River Land District.

NTS MAP SHEETS: 93 P. 12

BCGS MAP SHEETS: 093P.062

CLASSIFICATION: II C **RANKING VALUE: 8**

Aquifer Size:

2.88 km^2.

Aquifer Boundaries:

This small unconsolidated aquifer has been delineated on the basis of well development (wells completed in unconsolidated deposits and bordering bedrock wells), topography, and surficial geology (Reimchen, 1971). The boundaries of this aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

Well records show clay, silt, boulders and till overlie the aquifer.

Geologic Formation (aquifer):

Glaciofluvial deposits, unconsolidated

Confined/Unconfined/Bedrock:

Confined.

Vulnerability:

Low. Wells are completed in an unconsolidated aquifer (glaciofluvial) that is generally confined from ground surface by material described as sandy silt, sandy clay, clay and till. The estimated thickness of confining material ranges from 0 to 61 m (0 to 200 ft). The median and geometric mean of confining material has been determined as 21.3 and 12.5 m (70 and 41 ft) respectively while the average thickness has been determined as 21.6 m (71 ft). Well records do suggest one *window* of vulnerability exist within the boundaries of this aquifer.

Productivity:

Moderate. Reported well yields range between 0.06 and 3.79 L/s (1 and 60 USgpm). The median and geometric mean well yields are 0.63 L/s and 0.63 L/s (10 and 10 USgpm) while the average yield has been determined as 1.14 L/s (18 USgpm). Well yields *reported* are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. There are no pumping test data available.

Depth to Water Table:

Groundwater levels reported are relatively shallow ranging between 1.8 and 26.5 m (6 and 87 ft). Groundwater levels have not been reported on several well records. The median and geometric mean groundwater levels have been determined as 8.8 and 7.3 m (29 and 24 ft) respectively while the average groundwater level has been determined as 9.1 m (30 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation (northwest to southeast) towards the Pine River floodplain. Long-term observation well data have not been analyzed to determine the direction of groundwater flow (see *Type of Water Use*)

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some wells located at lower elevation and adjacent to may be in hydraulic continuity with Windrem Creek

Domestic Well Density:

Moderate. There are approx. 6.6 wells / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water well use reported is domestic. There are however, several abandoned small diameter observation wells and test holes located within this aquifer. These wells were constructed under Government Contract in 1969.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Chetwynd area – North of Pine River. Peace River Land District.

AQUIFER REFERENCE NUMBER: 0626

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II C	**RANKING VALUE: 8**

Classification Component:

Level of Development: Moderate. Moderate level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low level of vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**1**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**8**

Statistical Analysis of Well Data for Aquifer 0626

Total number of wells available for statistical analysis: **19**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	19	12	7	12	16
Maximum	258	87	234	60	200
Minimum	31	6	16	1	0
Average	85	30	79	18	71
Median	80	29	60	10	70
Geometric Mean	74	24	56	10	41

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

AQUIFER REFERENCE NUMBER: 0627

DESCRIPTIVE LOCATION OF AQUIFER: Chetwynd area west to Dokie Siding – Peace River Land District

NTS MAP SHEET: 93 P. 12

BCGS MAP SHEETS: 093 P. 062 and 072.

CLASSIFICATION: III B **RANKING VALUE: 10**

Aquifer Size:

7.76 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of bedrock well development, topography, and surficial geology (Reimchen, 1971) and bedrock geology (McMechan, 1994). The boundaries of this linear bedrock aquifer have been shown as dashed (less certain). Normally, if the extent of surficial deposits changes abruptly between valley (flood plain deposits) and mountain (bedrock), the boundaries are shown as *solid*. This is not evident, however, as well records indicate that surficial deposits extend upslope on the mountain slopes.

Geologic Formation (overlying):

Well records indicate that clay and clay / gravel mixture (till?) and till overlie the bedrock aquifer.

Geologic Formation (aquifer):

The Bedrock aquifer is Mesozoic Era, Upper Cretaceous Period, Cruiser Formation: Dark grey sideritic shale. Well records show bedrock as broken shale, shale, and black shale. Some well records also show the bedrock as sandstone and sandstone with shale layering. Because of the complex and wide variety of hydraulic responses that are likely exhibited within this bedrock, it is more appropriate to term this bedrock as an aquifer *System* rather than simply a bedrock aquifer.

Confined/Unconfined:

The aquifer is confined by clay and till.

Vulnerability:

Moderate. Wells are completed in a bedrock aquifer (mostly shale and black shale) that is confined from ground surface by material described as clay and clay / gravel mix (till?) and till. The median and geometric mean thickness of confining material is 18.3 and 7.6 m (60 and 25 ft) respectively. The average thickness of confining material has been determined as 26.5 m (87 ft). One well record (093P.062.4.3.1 #9) however, suggests that a window of vulnerability may exist within the boundaries of this aquifer, where the shale lies at the surface.

Productivity:

Moderate. Reported well yields range between 0.13 and 4.42 L/s (2 and 70 USgpm). The median and geometric mean well yields are 0.5 L/s and 0.57 L/s (8 and 9 USgpm) while the average yield has been determined as 1 L/s (16 USgpm). Well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. There are no pumping test data available.

Depth to Water Table:

Groundwater levels reported range between flowing and 18.3 m (120 ft). The median and geometric mean groundwater levels have been determined as 9.1 and 5.2 m (30 and 17 ft) respectively while the average groundwater level has been determined as 11 m (36 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation towards the Pine River floodplain.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There are 2.7 wells / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water well use reported is domestic. There is however, one well that reports commercial and industrial use and one well constructed for the forestry service.

Reliance on Source:

Well water is the only known source of water in the area.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Chetwynd area west to Dokie Siding – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0627

AQUIFER TYPE: Bedrock

CLASSIFICATION: III B	**RANKING VALUE: 10**

Classification Component:

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**2**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0627

Total number of wells available for statistical analysis: **21**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	21	15	18	15	18
Maximum	404	120	370	70	355
Minimum	30	1	2	2	0
Average	205	36	105	16	87
Median	190	30	70	8	60
Geometric Mean	174	17	58	9	25

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

AQUIFER REFERENCE NUMBER: 0628

DESCRIPTIVE LOCATION: Chetwynd area – North of Pine River and encompassing Chetwynd Town site. Peace River Land District.

NTS MAP SHEET: 93 P 12

BCGS MAP SHEETS: 093 P. 062 and 072.

CLASSIFICATION: II B **RANKING VALUE: 8**

Aquifer Size:

1.55 km^2.

Aquifer Boundaries:

This small unconsolidated (alluvial fan) aquifer has been delineated on the basis of well development, topography, and surficial geology (Reimchen, 1971). Windrem Creek is centrally located within the boundaries of this aquifer. The boundaries of this aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

Well records show clay and sandy clay overlie the aquifer.

Geologic Formation (aquifer):

Alluvial fan deposits.

Confined/Unconfined:

Confined but with several *windows* of vulnerability.

Vulnerability:

Moderate. Wells are completed in an unconsolidated aquifer (alluvial fan) that is confined from ground surface in some areas by sandy clay and clay but well records suggest several *windows* of vulnerability exist within the boundaries of this aquifer. The thickness of confining material ranges from 0 (unconfined) to 8.5 m (28 ft). The median and geometric mean thickness has been determined as 4.6 and 1.5 m (15 and 5 ft) while the average thickness of confining material has been determined as 4.3 m (14 ft).

Productivity:

Low. Only one well yield has been reported (0.95 L/s or 15 USgpm). Comments on several well records suggest that obtaining an adequate water supply from the unconsolidated deposits in this area is poor. The presence of inter-layered silt and sandy silt within the formation would likely make proper well screen design and installation and development very difficult. The one well record (093P.072.2.2.1. #11) reporting an estimated yield of 0.95 L/s (15 USgpm) should be pump tested during the late summer / early fall to determine its reliability.

Depth to Water Table:

Groundwater levels reported are shallow ranging between 1.5 and 7.9 m (5 and 26 ft). The median and geometric mean groundwater level have been determined as 4.3 and 4m (14 and 13 ft) respectively, while the average groundwater level has been determined as 4.6 m (15 ft). Groundwater levels have not been reported on several well records. Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation towards the Pine River floodplain.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some wells located at lower elevation and adjacent to, may be in hydraulic continuity with Windrem Creek

Domestic Well Density:

Moderate. There are 7 wells / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Some water well use reported is domestic. There were however, several small diameter test holes constructed within this aquifer in 1978. Some earlier test holes were completed to determine the capacity for groundwater development. Many wells appear to have been abandoned.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Chetwynd area – North of Pine River. Peace River Land District.

AQUIFER REFERENCE NUMBER: 0628

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 8**

Classification Component:

Level of Development: Moderate. Low productivity in relation with moderate demand

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**1**
Vulnerability	**2**
Size:	**1**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**8**

Statistical Analysis of Well Data for Aquifer 0628

Total number of wells available for statistical analysis: **11**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	11	8	0	1	11
Maximum	165	26	N/A	15	28
Minimum	12	5	N/A	15	0
Average	46	15	N/A	N/A	14
Median	30	14	N/A	N/A	15
Geometric Mean	35	13	N/A	N/A	5

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

AQUIFER REFERENCE NUMBER: 0629

DESCRIPTIVE LOCATION OF AQUIFER: Chetwynd area – North of Chetwynd town site. Peace River Land District.

NTS MAP SHEET: 93 P 12

BCGS MAP SHEETS: 093 P. 072

CLASSIFICATION: II B **RANKING VALUE: 8**

Aquifer Size:

0.53 km^2.

Aquifer Boundaries:

This small unconsolidated (alluvial fan) aquifer has been delineated on the basis of well development, topography, and surficial geology (Reimchen, 1971). Windmark Creek is centrally located within the boundaries of this aquifer. The boundaries of this aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

Well records show clay overlies the aquifer.

Geologic Formation (aquifer):

Alluvial fan deposits.

Confined/Unconfined/Bedrock:

Confined but with *windows* of vulnerability.

Vulnerability:

Moderate. Wells are completed in a small unconsolidated aquifer (alluvial fan) that is confined from ground surface in some areas by clay. No information is given about potentially existing *windows* of vulnerability, however, other aquifer in the vicinity of aquifer #629 show the same king of geology, with *windows* of vulnerability. One well record reports alternating layers of gravel and clay. Only one well reports a confining thickness of 7.6 m (25 ft).

Productivity:

Low. Estimated well yields have not been reported on well records. Comments on well records suggest that obtaining an adequate water supply from the unconsolidated deposits in this area is poor. Glaciolacustrine deposits likely exist at depth. All wells here are "dug wells ".

Depth to Water Table:

Groundwater levels reported are shallow ranging between 0.6 and 2.4 m (2 and 8 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation towards the Pine River floodplain.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some wells located at lower elevation and adjacent to may be in hydraulic continuity with Widmark Creek

Domestic Well Density:

Moderate. The calculated well density is 8 wells per km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Two of the water wells report domestic use. One well record reports the well was a major water supply for this area until it was filled in.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Chetwynd area – North of Chetwynd town site. Peace River Land District.

AQUIFER REFERENCE NUMBER: 0629

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 8**

Classification Component:

Level of Development: Moderate. Moderate level of development in relation to low aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**1**
Vulnerability	**2**
Size:	**1**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**8**

Statistical Analysis of Well Data for Aquifer 0629

Total number of wells available for statistical analysis: **4**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	4	3	0	0	2
Maximum	35	8	N/A	N/A	25
Minimum	14	2	N/A	N/A	8
Average	20	6	N/A	N/A	17
Median	15	8	N/A	N/A	17
Geometric Mean	18	5	N/A	N/A	14

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 12, 2011

REFERENCE NUMBER: 0630

DESCRIPTIVE LOCATION: Jackfish Lake area – Northeast of Chetwynd and east of Moberly Lake - Peace River Land District.

NTS MAP SHEET: 93 P 13 and 14

BCGS MAP SHEET: 093 P. 073 and 083.

CLASSIFICATION: III C **RANKING VALUE: 8**

Aquifer Size:

8.25 km^2.

Aquifer Boundaries:

This unconsolidated (glaciofluvial – buried river channel) aquifer has been delineated on the basis of well development, topography, and surficial geology (Reimchen, 1971). The boundaries of this confined aquifer have been shown as solid where the aquifer is certain and defined by Jackfish Lake and at the change in slope between mountain and valley floor (glaciofluvial to moraine deposits). The boundaries of this aquifer have been shown as dashed where the boundaries are not as easily defined and therefore less certain.

Geologic Formation (overlying):

Well records show sand and gravel, and a thick deposition of silt and clay overlies the aquifer.

Geologic Formation (aquifer):

Glaciofluvial deposits underlying lacustrine deposits (buried river channel). Formation shows relatively even thickness and distribution throughout the boundaries of the aquifer. Jackfish Lake is a remnant of the ancient Pine river channel (Stott, 1961). Geologic cross-section constructed. PFRA test wells 1-95, 2-95, and 3-95 have not been included as locations are not plotted and are uncertain (Cowen, 1998).

Confined/Unconfined:

Confined. One well record located at a gravel pit on Jackfish Lake Road does suggest there may be a window of vulnerability near the southern boundary of this aquifer (093P.073.4.3.3 #1). The well lithology is questionable (drillers memory) however, and seems unlikely.

Vulnerability:

Low. Wells are completed in an unconsolidated aquifer (glaciofluvial) that is highly confined from ground surface with a thick deposition of clay and silt. The thickness of confining material ranges from 0 to 124 m (0 to 407 ft). The median and geometric mean thickness of confining material has been determined as 86.7 to 45.4 m (285 and 149 ft) while the average thickness has been determined as 78.3 m (257 ft).

Productivity:

Moderate to High. Reported well yields range between 0.06 and 4.42 L/s (1 and 70 USgpm). The median and geometric mean well yields are 1.26 and 0.95 L/s (20 and 15 USgpm) while the average yield has been determined as 1.32 L/s (21 USgpm). Well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. No pumping test data are available.

Depth to Water Table:

Groundwater levels reported are deep ranging between 18.3 and 62.5 m (60 and 205 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Recharge could be very slow because of the thickness of confining material overlying the aquifer.

Domestic Well Density:

Low. There are about 2 wells / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water wells report domestic use. One well record reports the well is used for domestic or municipal use.

Reliance on Source:

Well water is the only known source of water for domestic and / or municipal use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented. Water quality reported to be good (Cowen, 1998)

Quality Concerns (type, source, level of concern):

None documented. Some well records report hard water with moderate to high iron (February 1987 field water quality survey). No health concerns reported. Further water quality reconnaissance is recommended.

Comments:

A cross-section has been constructed to illustrate the extent of the aquifer, thickness and uniformity of confining material and the hydrogeologic environments identified.

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Cowen, A., 1998. BC Peace Region – Groundwater Initiative Interim Report – 1998. Agriculture and Agri-Food Canada Prairie Farm Rehabilitation Administration. PFRA – Northern Alberta / BC Region.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

Stott, D.F., 1961. Paper 61-10. *Dawson Creek Map-Area British Columbia 93P*. Department of Mines and Technical Surveys. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Jackfish Lake area – Northeast of Chetwynd and east of Moberly Lake - Peace River Land District.

AQUIFER REFERENCE NUMBER: 0630

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C	**RANKING VALUE: 8**

Classification Component:

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**2**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**8**

Statistical Analysis of Well Data for Aquifer 0630

Total number of wells available for statistical analysis: **18**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	18	14	0	16	17
Maximum	490	205	N/A	70	407
Minimum	201	60	N/A	1	0
Average	363	125	N/A	21	257
Median	377	131	N/A	20	285
Geometric Mean	348	118	N/A	15	149

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0631

DESCRIPTIVE LOCATION: South of the Peace River, west of confluence with Kiskatinaw River – Peace River Land District.

NTS MAP SHEET: 94 A 1

BCGS MAP SHEETS: 094 A. 009 and 010.

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

43.72 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of bedrock well development, topography, and surficial geology (Reimchen, 1971 and Thurber Consultants Ltd., 1976) and bedrock geology (McMechan, 1994). Boundaries between surficial deposits (alluvial fans) and bedrock (Kaskapau formation over Dunvegan sandstone) have been defined by Thurber (1976) and by the Peace River to the north. The boundaries of this bedrock aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

Well records indicate that clay (glaciolacustrine deposits) overlies the bedrock aquifer.

Geologic Formation (aquifer):

Bedrock. Mesozoic Era, Upper Cretaceous Period. Kaskapau Dunvegan Formations: sandstone and shale. Well records show bedrock as sandstone and shale.

Confined/Unconfined:

Bedrock.

Vulnerability:

Low. Wells are completed in a bedrock aquifer (shale and sandstone) that is confined from ground surface by clay. The median and geometric mean thickness of the confining clay is 16.8 and 19.8 m (55 and 65 ft) respectively. The average thickness of confining material has been determined as 21.9 m (72 ft).

Productivity:

Moderate. Reported well yields range between 0.63 and 1.58 L/s (10 and 25 USgpm). The median and geometric mean well yields are 1.58 L/s and 1.32 L/s (25 and 21 USgpm) while the average yield has been determined as 1.39 L/s (22 USgpm). Well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. There are no pumping test data available.

Depth to Water Table:

Groundwater levels reported are relatively unknown with only one reported level (flowing). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation, the Peace and Kiskatinaw River Valleys.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There is less than 1 well / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Most water well use reported is domestic and agriculture.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

Thurber Consultants Ltd., 1976, Lower Peace River - Sites C and E Hydroelectric Development Proposals - Environmental Resource Atlas. Part of a Report to BC Hydro and Power Authority. Thurber File No. 15-2-40.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South of the Peace River – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0631

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C	**RANKING VALUE: 10**

***Classification Component*:**

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0631

Total number of wells available for statistical analysis: **9**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	9	1	6	5	6
Maximum	640	280	90	25	140
Minimum	90	280	40	10	40
Average	244	N/A	57	22	72
Median	200	N/A	50	25	55
Geometric Mean	201	N/A	55	21	65

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0633

DESCRIPTIVE LOCATION: South of the Peace River – Peace River Land District.

NTS MAP SHEET: 94 A 1

BCGS MAP SHEETS: 094A. 009 and 010.

CLASSIFICATION: III C **RANKING VALUE: 9**

Aquifer Size:

44.89 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of bedrock well development, topography, and surficial geology (Reimchen, 1971 and Thurber Consultants Ltd., 1976) and bedrock geology (McMechan, 1994). The boundaries of this bedrock aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

Well records indicate that clay and clay and rocks overlie the bedrock aquifer.

Geologic Formation (aquifer):

Bedrock. Mesozoic Era, Upper Cretaceous Period. Kaskapau and/or Dunvegan Formation: Shale and sandstone. Well records show bedrock as shale and sandstone.

Confined/Unconfined:

Confined by clay and till.

Vulnerability:

Low. Wells are completed in a bedrock aquifer (shale and sandstone) that is confined from ground surface by material described as clay and clay and rocks. The median and geometric mean thickness of confining material is 25.3 and 15.8 m (83 and 52 ft) respectively. The average thickness of confining material has been determined as 25 m (82 ft).

Productivity:

Moderate. Reported well yields range between 0.063 and 1.89 L/s (1 and 30 USgpm). The median and geometric mean well yields are 0.32 L/s and 0.32 L/s (5 and 5 USgpm) while the average yield has been determined as 0.57 L/s (9 USgpm). Well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. There are no pumping test data available.

Depth to Water Table:

Groundwater levels reported are relatively deep ranging between 3.04 and 79.2 m (10 and 260 ft.). The median and geometric mean groundwater levels have been determined as 25 and 23.1 m (82 and 76 ft) respectively while the average groundwater level has been determined as 33.2 m (109 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely regionally from areas of higher elevation to areas of low elevation (south to north) towards the Kiskatinaw River.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There is less than 1 well / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

Thurber Consultants Ltd., 1976, Lower Peace River - Sites C and E Hydroelectric Development Proposals - Environmental Resource Atlas. Part of a Report to BC Hydro and Power Authority. Thurber File No. 15-2-40.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South of the Peace River (Shearer Dale / Doe River) - Peace River Land District.

AQUIFER REFERENCE NUMBER: 0633

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 9**

Classification Component:

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0633

Total number of wells available for statistical analysis: **16**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	15	11	13	12	14
Maximum	400	260	200	30	200
Minimum	20	10	10	1	10
Average	178	109	78	9	82
Median	180	82	80	5	83
Geometric Mean	141	76	51	5	52

AQUIFER CLASSIFICATION WORKSHEET

DATE: September 30, 2003

REFERENCE NUMBER: 0634

DESCRIPTIVE LOCATION: South of the Peace River near Taylor.

NTS MAP SHEET: 94 A 02

BCGS MAP SHEETS: 93 P 97 / 98 and 94 A 07 / 08

CLASSIFICATION: III C **RANKING VALUE: 9**

Aquifer Size:

83.76 km^2

Aquifer Boundaries:

This large bedrock aquifer has been delineated on the basis of bedrock well development and dry boreholes, topography, and surficial geology (Reimchen, 1971 and Thurber, 1976) and bedrock geology (McMechan, 1994). The boundaries of this bedrock aquifer have been shown as dashed (less certain) to the east, west and north but solid along the Kiskatinaw River in the south.

Geologic Formation (overlying):

Well records indicate that clay and gumbo clay and clay with rocks till overlie the bedrock aquifer.

Geologic Formation (aquifer):

Bedrock. Mesozoic Era, Upper Cretaceous Period, Dunvegan Formation: shale and sandstone. Well records generally show bedrock as shale with sandstone layering. Well record lithology is poor. Because of the large size of this aquifer and the complex and wide variety of hydraulic responses that are likely exhibited within this bedrock, it is more appropriate to term this bedrock as an aquifer *System* rather than simply a bedrock aquifer.

Confined/Unconfined:

Confined by overlying clay, till and gumbo clay.

Vulnerability:

Low. Wells are completed in a bedrock aquifer (mostly shale) that is confined from ground surface by material described as clay and gumbo clay. The median and geometric mean thickness of confining material is 18.3 and 15.8 m (60 and 52 ft) respectively. The average thickness of confining material has been determined as 22.5 m (74 ft).

Productivity:

Moderate. Reported well yields range between 0.063 and 9.46 L/s (1 and 150 USgpm). The median and geometric mean well yields are 0.5 L/s and 0.44 L/s (8 and 7 USgpm) while the average yield has been determined as 0.95 L/s (15 USgpm). Well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable. There are no pumping test data available.

Depth to Water Table:

Groundwater levels reported are moderately deep ranging between 5.5 to 85.3 m (18 to 280 ft). The median and geometric mean groundwater levels have been determined as 15.2 and 17.4 m (50 and 57 ft) while the average depth to groundwater has been determined as 21.2 m (76 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely regionally from areas of higher elevation to areas of low elevation (south to north) towards the Peace River.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There is less than 1 well / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

Water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Callan, D.M., 1971. *Reconnaissance Hydrogeology of Bedrock Aquifers in the Ft. St. John Area (NTS 94A/6 and 94A/7*. Groundwater Division, Water Investigations Branch. File 94A/6,7 #2.

Farstad, L., Lord, T.M., Green A.J. and H.J. Hortie, 1965. Soil Survey of the Peace River Area in British Columbia. Report No. 8 of the British Columbia Soil Survey. University of British Columbia, British Columbia Department of Agriculture and Research Branch, Canada Department of Agriculture.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

Thurber Consultants Ltd., 1976. Lower Peace River Sites C and E Hydroelectric Development Proposals - *Environmental Resource Atlas*. Part of a Report to B.C. Hydro and Power Authority. Thurber File No. 15-2-40.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South of the Peace River, near Taylor.

AQUIFER REFERENCE NUMBER: 0634

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C **RANKING VALUE: 9**

Classification Component:

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0634

Total number of wells available for statistical analysis: **26**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	26	19	24	22	25
Maximum	520	280	530	150	329
Minimum	35	18	14	1	4
Average	150	76	87	15	74
Median	98	50	62	8	60
Geometric Mean	113	57	59	7	52

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0635

DESCRIPTIVE LOCATION: Southwest of Tumbler Ridge Town site - Peace River Land District.

NTS MAP SHEET: 93 P 3

BCGS MAP SHEET: 093P.015.2.2.3

CLASSIFICATION: II A **RANKING VALUE: 15**

Aquifer Size:

0.87 km^2.

Aquifer Boundaries:

This unconsolidated (buried alluvial fan) aquifer has been delineated on the basis of well development, topography, and surficial geology (Lowen, 1983). Geological cross-sections by Lowen (1983) showing the aquifer thickness and extent have helped to define the boundaries of this aquifer. These geologic cross sections indicate that the aquifer extends under Flatbed creek. The boundaries of this aquifer have been shown as solid along the edge of Flatbed creek and dashed where the boundaries are not as easily defined and therefore less certain.

Geologic Formation (overlying):

Recent alluvial fan deposits by Flatbed creek. Sands and gravels and discontinuous till.

Geologic Formation (aquifer):

Buried alluvial Fan (glacial). Mainly course gravel and highly transmissive.

Confined/Unconfined:

Confined (Leaky). The Flatbed Aquifer is only partially confined by till. The aquifer has also been classified as leaky-artesian (Lowen, 1983).

Vulnerability:

High. Wells are completed in an unconsolidated aquifer (buried alluvial fan) that is partially confined from ground surface by till (discontinuous). The maximum reported thickness of till is 46 m (151 ft) while the median and geometric mean confining thickness of confining material (clay and silt) has been determined as 6.4 and 1.2 m (21 and 4 ft) respectively. The average thickness of confining material has been determined as 10 m (33 ft). The thickness of confining material is however, questionable on several well records.

Several windows of vulnerability do exist within the boundaries of this aquifer. The confining material appears to be totally absent on a number of well records (e.g. 093P.015.2.2.3 #8, 9, 10, 11, 18).

Productivity:

High. Reported well yields range between 0.95 and 312 L/s (15 and 4940 USgpm). The median and geometric mean well yields are 13.8 and 16.1 L/s (219 and 255 USgpm) while the average yield has been determined as 44.4 L/s (704 USgpm). It should be noted that some well yields reported have been *projected* from lower pumping rates. The aquifer appears to be thicker and more productive (transmissive) on the south side of the Flatbed creek. Several of the wells have been completed as test wells. Two wells have been completed as production wells (PW 7 and PW 8). The two production wells are located in a very coarse zone within the aquifer comprised of mainly pebbles and cobbles.

Transmissivities range between 8.69×10^{-3} m^2/s (60,458 USgpd/ft) and 8.2×10^{-2} m^2/s (572, 460 USgpd/ft) for wells completed within the Flatbed creek aquifer (Lowen, 1983).
Some test wells have been completed simply as open hole into the water-bearing formation while others have been constructed with designed well screens.

Depth to Water Table:

Groundwater levels reported range between 1.5 and 23.5 m (5 and 77 ft). The median and geometric mean depth to groundwater has been determined as 6.1 and 6.1 m (20 and 20 ft) respectively, while the average depth to groundwater has been determined as 7.6 m (25 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year. Provincial Observation Well 286 (1983 – present) located 100.5 m (330 ft) south of Flatbed creek does however; provide a continuous long-term record of groundwater levels within this aquifer (attached). Groundwater levels in observation well 286 range between approximately 6 and 13 m (19.6 and 42.6 ft) below ground level during the 20 year period 1983 to 2003.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) and Flatbed creek

Domestic Well Density:

There are no domestic wells reported, however there are two very high capacity municipal supply wells.

Type of Water Use:

Most water wells are test wells completed in 1983 as part of a Groundwater Exploration and Development Program conducted by Ker, Priestman and Associates Ltd. (Lowen, 1983). Two of the wells were completed as production wells (PW 7 and PW 8), these wells supply Tumbler Ridge.

Reliance on Source:

Well water is the only known source of water for municipal use. Flatbed creek may also be used as a licensed water supply.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

High level of iron, regional concern.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Lowen, D.A, 1983. *Tumbler Ridge Groundwater Exploration and Development.* Prepared by Ker, Priestman and Associates Ltd. Consulting Engineers, 300-2659 Douglas Street, Victoria, BC, V8T 4M3 for Town site of Tumbler Ridge. File 21671/05. Groundwater Section, Ministry of Environment, Lands and Parks NTS File 93P/3, 2 #22.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Southwest of Tumbler Ridge Town site – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0635

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II A **RANKING VALUE: 15**

Classification Component:

Level of Development: Moderate. Moderate level of development in relation to high aquifer productivity.

Level of Vulnerability: High vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**3**
Vulnerability	**3**
Size:	**1**
Demand:	**2**
Type of Use:	**3**
Quality Concerns:	**3**
Quantity Concerns:	**0**
Total:	**15**

Statistical Analysis of Well Data for Aquifer 0635

Total number of wells available for statistical analysis: **19**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	18	11	6	16	18
Maximum	293	77	209	4940	151
Minimum	30	5	17	15	0
Average	159	25	142	704	33
Median	156	20	163	219	21
Geometric Mean	142	20	113	255	4

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0636

DESCRIPTIVE LOCATION: East of Ft. St. John near Goodlow – Peace River Land District.

NTS MAP SHEET: 94 A 8

BCGS MAP SHEETS: 094A.040

CLASSIFICATION: III C **RANKING VALUE: 8**

Aquifer Size:

3.90 km^2.

Aquifer Boundaries:

This unconsolidated (glaciolacustrine) aquifer has been delineated on the basis of well development, topography, and surficial geology (Mathews, 1972). The boundaries of this aquifer have been shown as dashed as the boundaries are not easily defined and therefore less certain.

Geologic Formation (overlying):

Glaciolacustrine deposits (clay and silt).

Geologic Formation (aquifer):

Minor gravel and sand within glaciolacustrine deposits. Based on the well screen slot size noted on well record (094A.040.1.4.2 #1) the water bearing material could be much *finer* than reported on the well record(s).

Confined/Unconfined:

Confined by glaciolacustrine deposits (clay and silt).

Vulnerability:

Low. Wells are completed in an unconsolidated aquifer that is mainly confined from ground surface by clay and silt and possible till. The maximum reported thickness of the confining material is 76.8 m (252 ft) while the median and geometric mean thickness of confining material (clay and silt) has been determined as 43.3 and 11.6 m (142 and 38 ft) respectively. The average thickness of confining material has been determined as 42 m (138 ft). One well record however, (094A.040.1.2.4 #2) reported unconfined conditions exist within the aquifer. The lithology is questionable as the well is reported to be silting off and the water level was reported as "used to flow". Because a window of vulnerability (or more) may exist within the aquifer the vulnerability has been classified as moderate.

Productivity:

Moderate. Only a few well records report estimated yield (0.37 L/s or 5 USgpm and 3.2 L/s or 42 USgpm). Only one well has been constructed with a well screen. Two wells have been constructed with perforated casing opposite the water bearing zones.

Depth to Water Table:

Only one well record have reported a water level of 12.2 m (40 feet).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) and Alces creek.

Domestic Well Density:

Low. Calculated well density is 1.3 per km^2.

Type of Water Use:

Domestic Use.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

One well reports groundwater has high *soda.*

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Mathews, W.H., 1972. Surficial Geology Charlie Lake, Peace River District, British Columbia. Map 1460A. Geological Survey of Canada. Department of Energy, Mines and Resources.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: East of Ft. St. John, near Goodlow – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0636

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 8**

Classification Component:

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**1**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**8**

Statistical Analysis of Well Data for Aquifer 0636

Total number of wells available for statistical analysis: **5**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	5	1	1	3	5
Maximum	284	40	285	42	252
Minimum	145	40	285	5	0
Average	193	N/A	N/A	27	138
Median	178	N/A	N/A	35	142
Geometric Mean	187	N/A	N/A	19	38

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0637

DESCRIPTIVE LOCATION: North of Blueberry River and between Prespatou and Umbach creeks - north of Ft. St. John – Peace River Land District.

NTS MAP SHEET: 94 A 14

BCGS MAP SHEETS: 094A.085 and 095

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

83.8 km^2

Aquifer Boundaries:

This unconsolidated aquifer has been delineated on the basis of well development, water bodies (Umbach and Prespatou creeks) and surficial geology (Mathews, 1972). The boundaries of this aquifer have been shown as dashed as the boundaries are not easily defined and therefore less certain.

Geologic Formation (overlying):

Likely glaciolacustrine deposits of stony silty clay and silt (Mathews, 1972). Well record lithology not available as well records missing.

Geologic Formation (aquifer):

Likely glacial deposits (possibly till and stony clay with minor sand and gravel).

Confined/Unconfined:

Confined with *possible* windows of vulnerability.

Vulnerability:

Low. Wells are completed in an unconsolidated aquifer that is generally confined from ground surface by clay and silt and possible till. There may be windows of vulnerability within the aquifer. Well record lithology is not available (well cards missing).

Productivity:

Moderate. Reported estimated well yields range between 0.13and 1.26 L/s (2 to 20 USgpm). The median and geometric mean estimated well yields have been determined as 0.63 and 0.44 L/s (10 and 7 USgpm). The average reported estimated well yield has been determined as 0.57 L/s (9 USgpm). Only two wells have been constructed with well screens.

Depth to Water Table:

Groundwater levels reported range between 5.5 and 29.6 m (18 and 97 ft) while the median and geometric mean groundwater levels have been determined as 8.5 and 9.7 m (28 and 32 ft). The average groundwater level has been determined as 12.2 m (40 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) and nearby creeks and creek tributaries.

Domestic Well Density:

Low. Less than 1 well per km^2.

Type of Water Use:

Domestic Use.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although one well reports groundwater has high *soda.*

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Mathews, W.H., 1972. Surficial Geology Charlie Lake, Peace River District, British Columbia. Map 1460A. Geological Survey of Canada. Department of Energy, Mines and Resources.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: North of Blueberry River and between Prespatou and Umbach creeks - north of Ft. St. John – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0637

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C **RANKING VALUE: 10**

Classification Component:

Level of Development: Low. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0637

Total number of wells available for statistical analysis: **7**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	7	6	0	7	5
Maximum	258	97	N/A	20	158
Minimum	21	18	N/A	2	36
Average	105	40	N/A	9	78
Median	82	28	N/A	10	66
Geometric Mean	81	32	N/A	7	69

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0638

DESCRIPTIVE LOCATION: North of Blueberry River and between Snyder and Buick creeks - north of Ft. St. John – Peace River Land District.

NTS MAP SHEET: 94 A 14

BCGS MAP SHEETS: 094A.074, 075, 084 and 085.

CLASSIFICATION: III C **RANKING VALUE: 8**

Aquifer Size:

20.35 km^2.

Aquifer Boundaries:

This unconsolidated aquifer has been delineated on the basis of well development, water bodies (Snyder and Buick creeks) and surficial geology (Mathews, 1972). The boundaries of this aquifer have been shown as dashed as the boundaries are not easily defined and therefore less certain.

Geologic Formation (overlying):

Likely glaciolacustrine deposits of stony silty clay and silt (Mathews, 1972). Well record lithology not available as well records missing.

Geologic Formation (aquifer):

Likely glacial deposits (possibly till and stony clay with minor sand and gravel).

Confined/Unconfined:

Confined with possible windows of vulnerability.

Vulnerability:

Low. Wells are completed in an unconsolidated aquifer that is confined from ground surface by clay and silt and possible till.

Productivity:

Low. Reported estimated well yields range between 0.19 and 1.14 L/s (3 to 18 USgpm). The median and geometric mean estimated well yields have been determined as 0.25 and 0.38 L/s (4 and 6 USgpm). The average reported estimated well yield has been determined as 0.5 L/s (8 USgpm). Only one well has been constructed with a well screen.

Depth to Water Table:

Groundwater levels reported are range between 8.5 and 9.4 m (28 and 31 ft) while the median and geometric mean groundwater levels have been determined as 9.1 and 8.8 m (30 and 29 ft). The average groundwater level has been determined as 9.1 m (30 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) and nearby creeks and creek tributaries.

Domestic Well Density:

Low. Less than 1 well per km^2.

Type of Water Use:

Domestic Use.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although one well reports groundwater has high *soda.*

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Mathews, W.H., 1972. Surficial Geology Charlie Lake, Peace River District, British Columbia. Map 1460A. Geological Survey of Canada. Department of Energy, Mines and Resources.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: North of Blueberry River and between Snyder and Buick creeks - north of Ft. St. John – Peace River Land District.

AQUIFER REFERENCE NUMBER: 0638

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III C	**RANKING VALUE: 8**

Classification Component:

Level of Development: Low, very low level of development in relation to low aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**1**
Vulnerability	**1**
Size:	**2**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**8**

Statistical Analysis of Well Data for Aquifer 0638

Total number of wells available for statistical analysis: **6**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	6	2	1	3	3
Maximum	158	31	40	18	144
Minimum	43	28	40	3	40
Average	102	30	N/A	8	90
Median	112	30	N/A	4	86
Geometric Mean	93	29	N/A	6	79

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0639

AQUIFER LOCATION: North of Blueberry River and south of Prespatou – northwest of Rose Prairie.

NTS MAP SHEET: 94 A 14

BCGS MAP SHEETS: 094A. 74 / 75 / 76 / 84 / 85 / 93 / 94 / 95 / 96

CLASSIFICATION: III C **RANKING VALUE: 10**

Aquifer Size:

844.84 km^2

Aquifer Boundaries:

This large bedrock aquifer *system* has been delineated on the basis of bedrock well development and dry boreholes, topography, and bedrock geology (McMechan, 1994). The boundaries of this bedrock aquifer system have been shown as dashed (less certain) except along Blueberry and Beatton Rivers where the depth of the valley (> 100 m. below local plateau) make these certain hydrogeology boundaries.

Geologic Formation (overlying):

Well records indicate that clay and till overlie the bedrock aquifer. The clay has often been described on well records as *soft, wet* and *sticky* from ground surface.

Geologic Formation (aquifer):

Bedrock. Mesozoic Era. Upper Cretaceous Period. Dunvegan Formation: shale and sandstone. Well records generally show bedrock as shale with sandstone layering or sandstone with shale layering. The bedrock has also been described on well records as *soft or hard*. Because of the large size of this aquifer and the complex and wide variety of hydraulic responses that are likely exhibited within this bedrock, it is more appropriate to term this bedrock as an aquifer *system* rather than simply a bedrock aquifer.

Confined/Unconfined:

Confined mainly by clay and till.

Vulnerability:

Low. Wells are completed in a bedrock aquifer that is confined from ground surface by material generally described as clay and till. The thickness of confining material ranges between 1.5 and 94.5 m (5 and 310 ft) while the median and geometric mean thickness of confining material has been determined as 10.6 and 11.9 m (35 and 39 ft) respectively. The average thickness of confining material has been determined as 18.9 m (62 ft).

Productivity:

Moderate. Reported well yields range between 0.13 and 15.8 L/s (2 and 250 USgpm). The median and geometric mean well yields are 1.3 L/s and 1.14 L/s (20 and 18 USgpm) while the average yield has been determined as 2 L/s (32 USgpm). Well yields reported are estimated by the driller and from pumping tests. Well yields reported suggest that the sedimentary bedrock aquifer (shale and sandstone) has a good capacity. Well records indicate that the bedrock is highly fractured and layered.

Depth to Water Table:

Groundwater levels reported are generally deep ranging between 0.6 to 61.9 m (2 and 203 ft). The median and geometric mean groundwater levels have been determined as 15.5 and 15.5 m (51 and 51 ft) while the average depth to groundwater has been determined as 21.9 m (72 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely regionally from areas of higher elevation to areas of low elevation

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There are only a few domestic wells reported (less than 1 domestic well / km^2). All wells mapped are assumed to be in use unless otherwise indicated. Many wells here were drilled for oil/gas exploration camps and there are some pockets of higher well density.

Type of Water Use:

Water well use reported is domestic and commercial .

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

McMechan, M.E., 1994. Map 1858A. *Geology and Structure Cross-Section, Dawson Creek, BC.* Geological Survey of Canada. NTS File 93P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: North of Blueberry River and south of Prespatou – northwest of Rose Prairie.

AQUIFER REFERENCE NUMBER: 0639

AQUIFER TYPE: Bedrock

CLASSIFICATION: III C	**RANKING VALUE: 10**

Classification Component:

Level of Development: Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0639

Total number of wells available for statistical analysis: **78**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	78	57	67	74	59
Maximum	638	203	322	250	310
Minimum	48	2	2	2	5
Average	168	72	73	32	62
Median	133	51	38	20	35
Geometric Mean	139	51	42	18	39

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

AQUIFER NUMBER: 0640

AQUIFER LOCATION: East of Tumbler Ridge Town site and north of Flatbed Creek – Peace River Land District.

NTS MAP SHEET: 93 P 2

BCGS MAP SHEET: 093P.016.1.3

CLASSIFICATION: III A **RANKING VALUE: 11**

Aquifer Size:

2.55 km^2.

Aquifer Boundaries:

This small unconsolidated aquifer has been delineated on the basis of well development, topography, and surficial geology (Lowen, 1983).

Geologic Formation (overlying):

Recent alluvial fan and lacustrine deposits (sands, gravels, silts and clays) and glacial deposits (till).

Geologic Formation (aquifer):

Raised alluvial gravel terrace. Mainly sand, gravel and cobbles or gravel with occasional silt, clay or till layers.

Confined/Unconfined:

Partially confined, by till, silts and clays.

Vulnerability:

High. Wells are completed in an unconsolidated aquifer that is only partially confined from ground surface by silt, clay or till. A number of test holes suggest that the only protection against contamination introduced at the ground surface is a thin layer of silt. Some test holes have no confining material above the aquifer. The maximum reported thickness of till is 9.4 m (31 ft) while the median and geometric confining thickness of confining material (clay and silt) has been determined as 3 and 2.1 m (10 and 7 ft) respectively. The average thickness of confining material has been determined as 3.9 m (13 ft).

Productivity:

High. Reported well yields range between 6.3 and 11.9 L/s (100 and 189 USgpm). The median and geometric mean well yields are 6.62 and 7.95 L/s (105 and 126 USgpm) while the average yield has been determined as 8.26 L/s (131 USgpm). PW 4A was pump tested for a period of 24 hours at a constant pumping rate of 9.6 L/s (152 USgpm) and the projected long-term yield has been determined as 11.9 L/s (189 USgpm). The Transmissivity of PW 4A has been determined as 3.6×10^{-3} m^2/s. It is apparent that PW 4A is the best of the Terrace aquifer wells (Lowen, 1983). It is apparent that the test holes have not been pump tested. Test holes have shown evidence of several thin water-bearing formations interspersed between confining layers of clay and till. As the depth to shale bedrock is relatively shallow, the aquifer appears to have limited available drawdown.

Depth to Water Table:

Groundwater levels are shallow and range between 6 and 26.8 m (20 and 88 ft). The median and geometric mean depth to groundwater has been determined as 18.3 and 19.2 m (60 and 63 ft) respectively, while the average depth to groundwater has been determined as 11.6 m (38 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels often vary seasonally, this measurement may not represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Groundwater monitoring (test holes) by Hardy Associates (1978) Ltd. have shown that groundwater flows in an *easterly to westerly* direction.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow). As production wells are completed above the elevation of Flatbed creek, groundwater recharge does not appear to occur from this source. The aquifer is "perched'' above the regional flow system.

Domestic Well Density:

There are no *domestic* wells reported to be located within this aquifer.

Type of Water Use:

Most water wells are test wells completed in 1981 as part of a Groundwater Exploration and Development Program conducted by Hardy Associates (1978) Ltd. Three of the wells were completed as production wells (PW 1, PW 3 and PW 4A).

Reliance on Source:

Well water is the only known source of water for municipal use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Based on a 1983 water quality analysis (PW 4A) the groundwater is moderately mineralized (TDS=406 mg/L), alkaline (total alkalinity = 355 mg/L) and very hard (hardness = 340 mg/L). Hardness in groundwater is however, mainly an aesthetic concern.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Lowen, D.A, 1983. *Tumbler Ridge Groundwater Exploration and Development.* Prepared by Ker, Priestman and Associates Ltd. Consulting Engineers, 300-2659 Douglas Street, Victoria, BC, V8T 4M3 for Town site of Tumbler Ridge. File 21671/05. Groundwater Section, Ministry of Environment, Lands and Parks NTS File 93P/3, 2 #22.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Southeast of Tumbler Ridge Town site and north of Flatbed Creek – Peace River Land District.

AQUIFER NUMBER: 0640

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III A **RANKING VALUE: 11**

***Classification Component*:**

Level of Development: Low level of development in relation to high aquifer productivity.

Level of Vulnerability: High vulnerability to surface contamination.

Ranking Component:	***Ranking Value***
Productivity	**3**
Vulnerability	**3**
Size:	**1**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**11**

Statistical Analysis of Well Data for Aquifer 0640

Total number of wells available for statistical analysis: **21**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	21	10	7	3	19
Maximum	150	88	76	189	31
Minimum	30	20	19	100	0
Average	67	38	57	131	13
Median	60	28	63	105	10
Geometric Mean	63	33	53	126	7

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

AQUIFER NUMBER: 0687

DESCRIPTIVE LOCATION: Taylor Flats, south of the Peace River and southeast of Ft. St. John – Peace River Land District.

NTS MAP SHEET: 94A/2.

WELL LOCATION MAP: BCGS Trim Map: 094A.017.

CLASSIFICATION: II B **RANKING VALUE: 10**

Aquifer Size:

1.0 km^2.

Aquifer Boundaries:

This unconsolidated aquifer has been delineated on the basis of well development, topography, and surficial geology (Reimchen, 1971). The boundaries of this small aquifer have been shown as solid where bordering the Peace River and dashed inland where they are not easily defined and therefore less certain.

Geologic Formation (overlying):

Overlying material is described on well records as *gumbo clay and silty or sandy clay*. Well records show relative uniformity in both deposition and thickness of the overlying material.

Geologic Formation (aquifer):

Alluvial fan deposits. Alluvium appears to be well sorted sediment as indicated on well records.

Confined/Unconfined/Bedrock:

Confined and partially confined by *clay, silty and / or sandy clay and clay with sand layers.*

Vulnerability:

Moderate. Wells are completed in an unconsolidated aquifer that is confined or partially confined from ground surface by material described on well records as *clay, silty and / or sandy clay, and clay with sand layers.* The thickness of the confining or partially confining material ranges between 0 and 12 m (0 and 40 ft) thick. The median and geometric mean thickness of this material has been determined as 5.5 and 3.3 m (18 and 11 ft) respectively. The average thickness has been determined as 5.5 m (18 ft).

Productivity:

Moderate. Reported well yields range between 0.32 and 12.6 L/s (5 and 200 USgpm). The median and geometric mean well yields are 0.95 L/s and 1.2 L/s (15 and 19 USgpm) while the average yield has been determined as 2.52 L/s (40 USgpm). Pumping test data are *not* available and all well yields *reported* are estimated by the driller based on short-term bail or air-tests only. Results obtained can often be unreliable. Wells have not been completed with designed well screens and are therefore *hydraulically inefficient*. It appears that all wells are simply completed open hole in the water-bearing formation. Reported well yields are likely therefore conservative.

Depth to Water Table:

Groundwater levels are *shallow* reported range between 4.5 and 37.2 m (15 and 122 ft). The median and geometric mean groundwater levels have been determined as 9.1 and 11.6 m (30 and 38 ft) while the average groundwater level has been determined as 15.8 m (52 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels do vary seasonally, this measurement is not intended to represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation (south) to areas of low elevation (north).

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some wells located at lower elevation and close to the Peace River may be in hydraulic continuity with the Peace River.

Domestic Well Density:

Moderate. There are approx. 12 domestic wells / km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

All water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

Isolated. Field water quality results carried out in 1981 using a *Hach Kit* indicate the groundwater can be very hard (hardness = 1800 mg/L). One well reports hydrogen sulphide odor while another well reports elevated iron. Another well reports the groundwater is *not fit to drink* suggesting elevated coliform bacteria. Laboratory water quality analyses are not available. Although elevated iron may not pose a health risk, a hardness of 1800 mg/L suggests that the groundwater is highly mineralized. A hardness greater than 1000 mg/L is normally considered *unacceptable* for domestic purposes.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Reimchen, H.M.A., 1970,71. Map 1467A. *Surficial Geology of Dawson Creek, BC*. Department of Mines and Resources. Mines, Forests and Scientific Services Branch. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Taylor Flats, south of the Peace River and southeast of Ft. St. John – Peace River Land District.

AQUIFER NUMBER: 0687

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B	**RANKING VALUE: 10**

Classification Component:

Level of Development: Heavy. Heavy level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination.

Ranking Component:	***Ranking Value***
Productivity	**2**
Vulnerability	**2**
Size:	**1**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**10**

Statistical Analysis of Well Data for Aquifer 0687

Total number of wells available for statistical analysis: **12**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	12	7	0	8	11
Maximum	136	122	N/A	200	40
Minimum	28	15	N/A	5	0
Average	56	52	N/A	40	18
Median	42	30	N/A	15	18
Geometric Mean	48	38	N/A	19	11

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

AQUIFER NUMBER: 0688

DESCRIPTIVE LOCATION: East of Chetwynd and north of the Pine River – Peace River Land District.

NTS MAP SHEET: 93P/11.

WELL LOCATION MAP: BCGS Trim Map: 093P.063.

CLASSIFICATION: II C **RANKING VALUE: 9**

Aquifer Size:

Approx. 15.20 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of well development, topography, and bedrock geology (Stott, 1971)). The boundaries of this aquifer have been shown as dashed because they are not easily defined and therefore less certain.

Geologic Formation (overlying):

Clay and glacial till.

Geologic Formation (aquifer):

Fractured bedrock (shales and sandstones). Dunvegan formation of the Upper Cretaceous Period.
A few well records report layered (laminated) sandstone and shale, typical of the Dunvegan formation.

Confined/Unconfined/Bedrock:

Bedrock.

Vulnerability:

Low. Wells are completed in a bedrock aquifer that is confined from ground surface by material described on well records as *clay and glacial till.* The thickness of the confining material ranges between 0 and 44.2 m (0 and 145 ft) thick. The median and geometric mean thickness of this material has been determined as 10.7 and 7.6 m (35 and 25 ft) respectively. The average thickness has been determined as 11.2 m (38 ft). Available data suggest that one window of vulnerability exists within the boundaries of this aquifer.

Productivity:

Moderate. Reported well yields range between 0.06 and 6.62 L/s (1 and 105 USgpm). The median and geometric mean well yields are 0.50 L/s and 0.38 L/s (8 and 6 USgpm) while the average yield has been determined as 0.69 L/s (11 USgpm). All well yields reported are estimated by the driller based on short-term bail or air-tests only and results obtained can be unreliable. Pumping test data are not available. The hydraulic characteristics of the aquifer (coefficients of transmissivity and storage) cannot therefore be defined.

Depth to Water Table:

Groundwater levels are *moderately shallow* ranging between 0.38 and 8.14 m (6 and 129 ft). The median and geometric mean groundwater levels have been determined as 15.2 and 13.4 m (50 and 44 ft) while the average groundwater level has been determined as 15.8 m (52 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels do vary seasonally, this measurement is not intended to represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Moderate. There is less than 1 domestic well / km^2. Most wells are however, clustered and centrally distributed within the aquifer. For this reason, the demand ranking and level of development have been increased to moderate. All wells are assumed to be in use unless otherwise indicated.

Type of Water Use:

All water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although the groundwater has been reported on several well records as hard, *hardness* has not been measured.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Stott, D.F., 1961. Paper 61-10. *Dawson Creek Map-Area, British Columbia 93P* Department of Mines and Technical Surveys. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: East of Chetwynd and north of the Pine River – Peace River Land District.

AQUIFER NUMBER: 0688

AQUIFER TYPE: Bedrock

CLASSIFICATION: II C **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate. Moderate level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**2**
Demand:	**2**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0688

Total number of wells available for statistical analysis: **31**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	31	25	31	30	31
Maximum	400	129	145	105	145
Minimum	95	6	5	1	0
Average	214	52	40	11	38
Median	185	50	35	8	35
Geometric Mean	195	44	30	6	25

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

AQUIFER NUMBER: 0689.

DESCRIPTIVE LOCATION: Southeast of Chetwynd, south of Pine River and north of Lone Prairie – Peace River Land District.

NTS MAP SHEET: 93P 11

WELL LOCATION MAP: BCGS Trim Map: 093P.53 / 54 / 63 / 64

CLASSIFICATION: II C **RANKING VALUE: 9**

Aquifer Size:

75.1 km^2.

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of bedrock geology as indicated on well records and by Stott (1961) and *limited* well development. As more well record data becomes available the aquifer boundaries will very likely be expanded and re-defined. The boundaries of this aquifer have been shown as dashed except along the Kiskatinaw River (east boundary) because they are generally not easily defined and therefore less certain.

Geologic Formation (overlying):

Clay and glacial till.

Geologic Formation (aquifer):

Fractured bedrock (shales and sandstones). Dunvegan formation of the Upper Cretaceous Period.
A few well records report layered (laminated) sandstone and shale, typical of the Dunvegan formation.

Confined/Unconfined/Bedrock:

Bedrock.

Vulnerability:

Low. Wells are completed in a bedrock aquifer that is confined from ground surface by material described on well records as *clay and glacial till.* The thickness of the confining material ranges between 4.6 and 68.6 m (15 and 225 ft) thick. The median and geometric mean thickness of this material has been determined as 22.8 and 20.4 m (75 and 67 ft) respectively. The average thickness has been determined as 26.2 m (86 ft). Available data suggest that *windows of vulnerability* do *not* exist within the boundaries of this aquifer.

Productivity:

Moderate. Reported well yields range between 0.13 and 3.79 L/s (2 and 60 USgpm). The median and geometric mean well yields are 0.38 L/s and 0.38 L/s (6 and 6 USgpm) while the average yield has been determined as 0.76 L/s (12 USgpm). All well yields *reported* are estimated by the driller based on short-term bail or air-tests only and results obtained can be unreliable. Pumping test data are not available. The hydraulic characteristics of the aquifer (coefficients of transmissivity and storage) cannot therefore be defined.

Depth to Water Table:

Groundwater levels are *moderately shallow* ranging between 6.1 and 38.1 m (20 and 125ft). The median and geometric mean groundwater levels have been determined as 15.2 and 14.6 m (50 and 48 ft) while the average groundwater level has been determined as 17.7 m (58 ft). Although groundwater levels above suggest the aquifer may be more vulnerable than the specific vulnerability assigned, the *low permeability* overlying sediments are the more dominant physical characteristic of the aquifer. Groundwater levels reported are also measured only once (at the time of well construction). As groundwater levels do vary seasonally, this measurement is not intended to represent local water table conditions throughout the year.

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty but ignoring geologic complexities, likely from areas of higher elevation to areas of low elevation. The small bedrock aquifer is surrounded by areas of higher elevation.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. Domestic well density is 0.17 wells/km^2. All wells are assumed to be in use unless otherwise indicated.

Type of Water Use:

All water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although the groundwater has been reported on several well records as hard, *hardness* has not been measured.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Stott, D.F., 1961. Paper 61-10. *Dawson Creek Map-Area, British Columbia 93P* Department of Mines and Technical Surveys. Geological Survey of Canada. NTS File 93 P.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Southeast of Chetwynd, south of Pine River and north of Lone Prairie – Peace River Land District.

AQUIFER NUMBER: 0689

AQUIFER TYPE: Bedrock

CLASSIFICATION: II C **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate. Low level of demand in relation to moderate aquifer productivity.

Level of Vulnerability: Low vulnerability to surface contamination.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0689

Total number of wells available for statistical analysis: **13**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	13	9	10	9	9
Maximum	310	125	225	60	225
Minimum	63	20	15	2	15
Average	201	58	85	12	86
Median	210	50	78	6	75
Geometric Mean	180	48	68	6	67

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

REFERENCE NUMBER: 0690

DESCRIPTIVE LOCATION: Clayhurst Area and extending east to the Alberta Border.

NTS MAP SHEET: 094 A 1

BCGS MAP SHEETS: 094 A.020 and 030.

CLASSIFICATION: III B **RANKING VALUE: 9**

Aquifer Size:

23.8 km^2.

Aquifer Boundaries:

This unconsolidated aquifer has been delineated on the basis of well development (wells completed in the aquifer and bordering wells completed in bedrock), topography, and surficial geology (Mathews, W. H., 1978). The boundaries of this aquifer have been shown as dashed (less certain).

Geologic Formation (overlying):

The aquifer is overlain by clay, clay and silt layers or clay and till layers. The thickness of overlying soils ranges from 11.3 to 26 m (37 to 85 ft).

Geologic Formation (aquifer):

The aquifer is comprised of sand and gravel, also some well logs refer to quicksand. One well 109 (WTN 16468) notes difficulty completing the well in quicksand so it was deepened for completion in bedrock. The sand and gravel aquifer overlies a bedrock aquifer (Aquifer No. 448). Mathews (1963) theorized that fluviatile sand and gravel at elevations greater than 152.4 m. (500 ft.) above Peace River are of pre-glacial age. This aquifer is located approximately 242.3 m (795 ft) above Peace River.

Confined/Unconfined/Bedrock:

The aquifer is confined by *clay and silt.*

Vulnerability:

Moderate. Wells are completed in an unconsolidated aquifer that is confined from ground surface by material described as *gumbo clay, clay, silt and clay and rock (till).* The thickness of confining material is variable ranging between 13.3 and 26 m (37 and 85 ft) thick. The median and geometric mean thickness of this confining material has been determined as 13.7 and 15.2 m (45 and 50 ft) thick respectively. The average thickness has been determined as 15.8 m (52 ft). Existing well record data suggest that the aquifer is completely confined with no *windows* of vulnerability. However the confining layer is thin in places (13 m) and maybe absent in some areas therefore a moderate vulnerability has been interpreted.

Productivity:

Moderate. Reported well yields range between 0.4 and 1.3 L/s (6 and 20 USgpm). The median and geometric mean well yields are 1.3 L/s and 1 L/s (20 and 16 USgpm) while the average yield has been determined as 1.1 L/s (17 USgpm). One well (WTN 19068) was pumped at 80 USgpm for 2 hours with no water levels recorded. Also no screens have been installed in these wells, the wells could produce more with properly designed screens. The majority of wells yields *reported* are estimated by the driller based on short-term bail or air-tests only and results obtained are often unreliable.

Depth to Water Table:

Groundwater levels reported range between 6 and 45.7 m (20 and 150 ft). The median and geometric mean groundwater levels have been both determined as 18.3 m (60 ft) while the average groundwater level has been determined as 23 m (76 ft). Groundwater levels reported are generally measured only once (at the time of well construction). As groundwater levels do vary seasonally, this measurement is not intended to represent local water table conditions throughout the year. Water level measurements apparently indicate artesian conditions at some wells and water table for others. For example WTN 45660 has loose gravel from 13.7 to 48.8 m (45 to 160 ft.) depths and a water level of 33.5 m. (110 ft). WTN 46390 has loose gravel from 26 to 30.5 m (85 to 100 ft) and a water level of 12.2 m (40 ft). Where the confining layer is thicker (and aquifer deeper) the artesian conditions occur.

Direction of Groundwater Flow:

A preliminary analysis of well elevations and water levels indicates a groundwater flow direction toward the east or southeast.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface. Some local creeks may also provide a portion of recharge.

Domestic Well Density:

Low. The calculated well density is 0.3 wells per km^2. All wells mapped are assumed to be in use unless otherwise indicated.

Type of Water Use:

All water well use reported is domestic.

Reliance on Source:

Well water is the only known source of water for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented. Although water quality concerns have not been specifically documented from wells located within this aquifer, water quality in surficial deposits throughout the Peace River District can be very hard, alkaline and highly mineralized. One well record (WTN 46390) also notes a sulphur odour in the water.

Comments:

For the purpose of standardization and to achieve all objectives of the aquifer mapping program, the document *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) was referenced in the preparation of this worksheet.

References:

Bernardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

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Le Breton, E. G. July 7, 1978. *A Preliminary Study of Groundwater Resources in Fort St. John Region.* Groundwater Section. Water Investigations Branch, B.C. Ministry of Environment File 0183613-C.

Locher, J. April 16, 1993. Memorandum to Paul Kemp, UMA Engineering, regarding PFRA Groundwater Testing.

Lord, T. M. and A. J. Green. 1986. *Soils of the Fort St. John – Dawson Creek Area, B.C. Report No 42*. British Columbia Soil Survey. Land Research Centre Contribution No. 85-27 Research Branch, Agriculture Canada.

Mathews, W. H. 1978. *Quaternary Stratigraphy and Geomorphology of Charlie Lake* (94A) Map Area, British Columbia. Geological Survey of Canada Paper 76-20. Energy, Mines and Resources Canada with Map 1460A Surficial Geology, Charlie Lake Peace River District, British Columbia. Scale 1:250,000.

Mathews, W. H. 1963. *Quaternary Stratigraphy and Geomorphology of the Fort St. John Area*, Northeastern British Columbia. B.C. Department of Minas and Petroleum Resources.

Mathews, W. H. 1955. *Groundwater Possibilities of the Peace River Block*, British Columbia. B.C. Dept. of Mines; Groundwater Paper No. 3.

Tradewell, E. April 3, 1979. City of Fort St. John Groundwater Availability. Memorandum to A. P. Kohut, Senior Geological Engineer, Groundwater Section, Water Investigations Branch. B.C. Ministry of Environment.

Thurber Engineering, June 1976. Lower Peace River, Sites C and E Hydroelectric Development Proposals, Environmental Resource Atlas, Report to B.C. Hydro and Power Authority.

UMA Engineering Ltd., August 1993. Groundwater Source Preliminary Investigation, Fort St. John, B.C.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Clayhurst Area and extending east to the Alberta Border.

AQUIFER REFERENCE NUMBER: 0690

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III B **RANKING VALUE: 9**

Classification Component:

Level of Development: Light. Low level of development in relation to moderate aquifer productivity.

Level of Vulnerability: Moderate vulnerability to surface contamination introduced at ground surface.

Ranking Component:	*Ranking Value*
Productivity	**2**
Vulnerability	**2**
Size:	**2**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0690

Total number of wells available for statistical analysis: **6**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	6	5	0	5	6
Maximum	180	150	N/A	20	85
Minimum	40	20	N/A	60	37
Average	118	76	N/A	17	52
Median	113	60	N/A	20	45
Geometric Mean	107	60	N/A	16	50

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 19, 2011

AQUIFER REFERENCE NUMBER: 0765

DESCRIPTIVE LOCATION OF AQUIFER: South of Tumbler Ridge

NTS MAP SHEETS: 93 P 02

BCGS MAP SHEETS: 93 I 86 / 96

CLASSIFICATION: II B **RANKING VALUE: 7**

Aquifer Size:

Area of aquifer is approximately 2.33 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated to encompass all the bedrock wells.

Aquifer Type:

Bedrock aquifer.

Geologic Formation (overlying material):

The well log records show an overlying formation composed of clay, till, broken rocks and conglomerates.

Geologic Formation (aquifer):

The aquifer is comprised of the Fort St. John Group unit of the Lower Cretaceous. It is mostly composed of shale, interbedded with sandstone, siltstone/mudstone and conglomerates. Its maximum thickness in the Peace River Region is estimated to range around 850 m (2780 ft).

Confined / Partially Confined / Unconfined:

Partially confined with clay and till. The well log records report one window of vulnerability.

Vulnerability:

Moderate. The depth to the water table has a geometric mean of 16.4 m (54 ft). The range of thickness of the confining layer in the well records range from 0 to 9.1 m (0 to 30 ft). The geometric mean thickness and the median of the confining layer are respectively 1.8 to 6.4 m (6 and 21 ft). The permeability overlying the formation present in only one well is low (clay and till). One well of seven does not report any confining layer.

Productivity:

Moderate. The well yields reported in the wells recorded range up to 4.7 L/s (75 USgpm). The geometric mean and the median of reported well yields are respectively 2.3 and 3.3 L/s (37 and 53 USgpm). The average of reported well yields is 2.9 L/s (46 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 16.5 m (54 ft). The median static water level is 17.4 m (57 ft) and the range of static water level is to 12.5 to 21.9 m (41 to 72 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Direct infiltration from the precipitation.

Domestic Well Density:

Low. There are approximately 2.1 wells per km^2.

Type of Water Use:

The uses are only commercial and industrial.

Reliance on Source:

Well water is the only known source.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in the aquifer is 112.5 m (369 ft). The median depth of wells is 115.2 m (378 ft) and the range of well depths is from 86.9 to 146.3 m (285 to 480 ft). The statistics quoted for this aquifer are based on a total of 7 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Massey, N.W.D et Al., 2005. *Digital Geology Map of British Columbia: Whole Province.* Geoscience BC, Map 2009-4-1, scale 1:500,000.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South of Tumbler Ridge

AQUIFER REFERENCE NUMBER: 0765

AQUIFER TYPE: Bedrock

CLASSIFICATION: II B **RANKING VALUE: 7**

Classification Component:

Level of Development: Moderate (moderate productivity and low demand)

Level of Vulnerability: Moderate (thin confining thickness with one window of vulnerability)

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	2
Area	1
Demand	1
Type of Use	1
Quantity concerns	0
Quality concerns	0
Total	**7**

Statistical Analysis of Well Data for Aquifer 0765

Total number of wells available for statistical analysis: **7**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	6	2	6	6	4
Maximum	480	72	30	75	30
Minimum	285	41	12	12	0
Average	376	57	20	46	18
Median	378	57	18	53	21
Geometric Mean	369	54	19	37	6

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 24, 2011

AQUIFER REFERENCE NUMBER: 0850

DESCRIPTIVE LOCATION OF AQUIFER: Fellers Heights

NTS MAP SHEETS: 93 P 10

BCGS MAP SHEETS: 93 P 68

CLASSIFICATION: II C **RANKING VALUE: 6**

Aquifer Size:

Area of aquifer is approximately 4.1 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well log records and some geographical elements, such as rivers. The eastern boundary of the aquifer is defined and follows the Kiskatinaw River. The other boundaries are undefined and are delineated in order to encompass the wells. The Northern and Western boundaries roughly follow the 740 m topographic line. The Southern boundary follows a little creek to the major River.

The unconsolidated formation containing the aquifer extends over the boundaries. They may be extended in the future if more wells are drilled.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

The surficial geology shows the western part of the area covered by lacustrine deposits. The eastern part along the river show some alluvial deposits.

Lacustrine deposits consist of clay, silt, sand and minor gravel size material deposited in a standing body of water. Alluvial deposits are detrital deposits consisting of silt, sand, gravel and minor coarser material (Reimchen, T.H.F., 1971 – Map 1467A).

Geologic Formation (aquifer):

The well log records indicate the aquifer in an inhomogeneous formation, ranging from clay with sand layers to coarse gravel.

Confined / Partially Confined / Unconfined:

Confined by a low permeability clay and silt formation.

Vulnerability:

Low. The range of thickness of the confining layer in the well records range from 85.3 to 131 m (280 to 430 ft). The geometric mean thickness and the median of the confining layer are respectively 100 and 101.5 m (328 and 333 ft). The permeability overlying the formation is low (clay and silt).

Productivity:

Moderate. The well yields reported in the wells recorded range up to 3.15 L/s (50 USgpm). The geometric mean and the median of reported well yields are respectively 1.39 and 1.89 L/s (22 and 30 USgpm). The average of reported well yields is 1.89 L/s (30 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 7.3 m (24 ft). The median static water level is 11.9 m (39 ft) and the range of static water level is to 2.4 to 21.3 m (8 to 70 ft).

Direction of Groundwater Flow:

The direction of the flow is northward, following the topographic gradient.

Recharge:

Precipitation and probably infiltration from the Kiskatinaw River.

Domestic Well Density:

Light. Approximately 0.7 wells/km^2.

Type of Water Use:

One well only reports a commercial/industrial use. However, the aerial photography of the area does not show any habitations, but only fields. Domestic wells are not expected in the aquifer.

Reliance on Source:

Well water is the only known source for domestic use. The Kiskatinaw River may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented

Notes:

The geometric mean depth of water wells in the aquifer is 73.8 m (242 ft). The median depth of wells is 85.3 m (280 ft) and the range of well depths is from 38.1 to 123.4 m (125 to 405 ft).

The statistics quoted for this aquifer are based on a total of 3 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Reimchen, T.H.F., 1971. Surficial Geology, Dawson Creek, British Columbia. Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa, ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Fellers Heights

AQUIFER REFERENCE NUMBER: 0850

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II C **RANKING VALUE: 6**

Classification Component:

Level of Development: Moderate (low demand in relation with moderate productivity).

Level of Vulnerability: Low (good confining thickness but only 3 wells reported. Shallow static water level).

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	1
Area	1
Demand	1
Type of Use	1
Quantity concerns	0
Quality concerns	0
Total	**6**

Statistical Analysis of Well Data for Aquifer 0850

Total number of wells available for statistical analysis: **3**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	3	2	1	2	2
Maximum	405	70	385	50	385
Minimum	125	8	385	10	280
Average	273	39	N/A	30	333
Median	290	39	N/A	30	333
Geometric Mean	245	24	N/A	22	328

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 19, 2011

AQUIFER REFERENCE NUMBER: 0851

DESCRIPTIVE LOCATION OF AQUIFER: Dawson Creek

NTS MAP SHEETS: 93 P 16

BCGS MAP SHEETS: 93 P 78 / 79 / 80 / 87 / 88 / 89 / 90 / 98 / 99 / 100

CLASSIFICATION: II C **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 866.44 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well log records. It shares a common boundary with the unconsolidated aquifer #903 and is separated from it by the Pouce Coupe River. The other boundaries are not well defined and are drawn in order to encompass all the unconsolidated wells. The aquifer 851 overlaps the bedrock aquifer #593.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

Most of the area is covered by morainal deposits. The southern and eastern parts are largely covered with lacustrine deposits. Overall, lacustrine deposits are present along the major creeks. The surficial map (1467A) shows numerous beach/wave-cut cliff and strandlines.

Morainal deposits consist of a heterogeneous assortment of clay to boulder size material, deposited directly from glacial ice. Lacustrine deposits are composed of clay, silt, sand and minor gravel size material, with fluviatile and/or glacial origins (Reimchen, T.H.F., 1971 – Map 1467A).

Geologic Formation (aquifer):

The well log records report a water-bearing formation composed of sand, boulders and gravel.

Confined / Partially Confined / Unconfined:

Confined with clay. Only 18 wells of 47 give information on the presence or not of confining thickness. However, none of the well reported show a window of vulnerability.

Vulnerability:

Low. The depth to the water table has a geometric mean of 7.6 m (25 ft). The range of thickness of the confining layer in the well records range from 1.2 to 61 m (4 to 200 ft). The geometric mean thickness and the median of the confining layer are respectively 16.1 to 22.6 m (53 and 74 ft). The overlying material is low permeability clay.

Productivity:

Moderate. The well yields reported in the wells recorded range up to 1.89 L/s (30 USgpm). The geometric mean and the median of reported well yields are respectively 0.32 and 0.19 L/s (5 and 3 USgpm). The average of reported well yields is 0.57 L/s (9 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 8.2 m (27 ft). The median static water level is 9.1 m (30 ft) and the range of static water level is to 5.5 to 12.5 m (18 to 41 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Direct infiltration from the precipitation and maybe infiltration from the several creeks running off above the aquifer.

Domestic Well Density:

Low. There is approximately one well for 20 km^2.

Type of Water Use:

The well log records report several types of uses: *domestic* and *other*.

Reliance on Source:

Well water is the only known source for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in the aquifer is 19.2 m (63 ft). The median depth of wells is 21.3 m (70 ft) and the range of well depths is from 6.7 to 121.9 m (22 to 400 ft).

The statistics quoted for this aquifer are based on a total of 43 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Reimchen, T.H.F., 1971. Surficial Geology, Dawson Creek, British Columbia. Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa, ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Dawson Creek

AQUIFER REFERENCE NUMBER: 0851

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II C **RANKING VALUE: 10**

Classification Component:

Level of Development: Moderate (low to moderate productivity and low demand).

Level of Vulnerability: Low (good confining layer)

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	1
Area	3
Demand	1
Type of Use	3
Quantity concerns	0
Quality concerns	0
Total	**10**

Statistical Analysis of Well Data for Aquifer 0851

Total number of wells available for statistical analysis: **43**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	33	21	1	7	18
Maximum	400	190	140	30	200
Minimum	22	4	140	1	4
Average	80	39	N/A	9	76
Median	70	18	N/A	3	74
Geometric Mean	63	25	N/A	5	53

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 19, 2011

AQUIFER REFERENCE NUMBER: 0903

DESCRIPTIVE LOCATION OF AQUIFER: East of Dawson Creek

NTS MAP SHEETS: 93 P 16

BCGS MAP SHEETS: 93 P 80 / 90

CLASSIFICATION: II B **RANKING VALUE: 9**

Aquifer Size:

Area of aquifer is approximately 33.9 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well log records. It shares a common boundary with the unconsolidated aquifer #851 and is separated from it by the Pouce Coupe River. The other boundaries are not well defined and are drawn in order to encompass all the unconsolidated wells. It may extend further to Alberta.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

Some alluvial deposits are present along Pouce Coupe River. The whole western part of the area is covered by lacustrine deposits. The eastern part shows patches of morainal deposits, and a large area in the south is filled with colluvial deposits.

Alluvial deposits consist of detrital deposits composed of silt, sand, gravel and minor coarser material. Morainal deposits consist of a heterogeneous assortment of clay to boulder size material, deposited directly from glacial ice. Lacustrine deposits are composed of clay, silt, sand and minor gravel size material, with fluviatile and/or glacial origins. Colluvial deposits are loose rubbles found on slopes, composed of a variable mixture of boulder to clay size. The surficial map (1467A) shows numerous beach/wave-cut cliff and strandlines. (Reimchen, T.H.F., 1971 – Map 1467A).

Geologic Formation (aquifer):

The well log records report a water-bearing formation composed of sand, boulders and gravel.

Confined / Partially Confined / Unconfined:

Partially confined with clay. Only one well of 4 gives information on the confining thickness, reporting clay. However, the surficial geology overlying the aquifer is very heterogeneous and can range from clay to coarser material. In the absence of a reasonable amount of data the aquifer will be considered as partially confined, increasing its level of vulnerability.

Vulnerability:

Moderate. The depth to the water table has a geometric mean of 7.6 m (24 ft). The only confining thickness reported is 4 m (13 ft). The overlying material reported is low permeability clay material.

Productivity:

Low. No information is given on the yield. In the absence of data, the productivity is considered to be at the lowest.

Depth to Water:

The geometric mean static water level is 7.6 m (24 ft). The median static water level is 17.4 m (57 ft) and the range of static water level is to 1.5 to 30.5 m (5 to 100 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty.

Recharge:

Direct infiltration from the precipitation and maybe infiltration from the several creeks running off above the aquifer.

Domestic Well Density:

Low. There is approximately one well for 8.5 km^2.

Type of Water Use:

Only one well log record reports a domestic use. The others are *unknown*.

Reliance on Source:

Well water is the only known source for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in the aquifer is 14.6 m (48 ft). The median depth of wells is 17.4 m (57 ft) and the range of well depths is from 6 to 36.6 m (20 to 120 ft).

The statistics quoted for this aquifer are based on a total of 4 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Reimchen, T.H.F., 1971. Surficial Geology, Dawson Creek, British Columbia. Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa, ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: East of Dawson Creek

AQUIFER REFERENCE NUMBER: 0903

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate (low productivity and low demand)

Level of Vulnerability: Moderate (almost no information on confining thickness and shallow water table)

Ranking Component	*Ranking value*
Productivity	1
Vulnerability	2
Area	3
Demand	1
Type of Use	2
Quantity concerns	0
Quality concerns	0
Total	**9**

Statistical Analysis of Well Data for Aquifer 0903

Total number of wells available for statistical analysis: **4**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	4	4	0	0	1
Maximum	120	100	N/A	N/A	13
Minimum	20	5	N/A	N/A	13
Average	64	46	N/A	N/A	N/A
Median	57	40	N/A	N/A	N/A
Geometric Mean	48	24	N/A	N/A	N/A

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 10, 2011

AQUIFER REFERENCE NUMBER: 0908

DESCRIPTIVE LOCATION OF AQUIFER: Halfway River

NTS MAP SHEETS: 94 B 10

BCGS MAP SHEETS: 94 A 41/51, 94 B 50/60

CLASSIFICATION: II B **RANKING VALUE: 9**

Aquifer Size:

Area of aquifer is approximately 22.9 km^2.

Aquifer Boundaries:

The aquifer boundary was delineated using water well record information (area of well development) and topography. The southern aquifer boundary follows the Halfway River bank.

The northern boundary follows a topographic line marking a sharp change of the slope between the unconsolidated valley and the bedrock aquifer plateau. Moreover, two bedrock wells are reported just above the fixed boundary.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

The area is covered with low permeable clay and silt. However, this cover is not homogeneous and some windows of high permeable sand occur in some places.

Geologic Formation (aquifer):

Halfway River is closely surrounded by modern alluvium, and further by terrace deposits. The terrace deposits consist of gravel sheets, covered with sand and/or silt. The *river-cut terraces* along Halfway River are well known and reported by Mathews W.H (1978) in the *quaternary Stratigraphy and geomorphology of Charlie Lake area*. The terrace deposits thickness in this area is expected to be less than 65 feet. Modern alluvium consists of *well sorted gravel and sand* covered by *sand and silt*.

Confined / Partially Confined / Unconfined:

Confined by a very thin layer of clay. Three wells of 5 do not have a confining layer. Waiting for more well records to improve the degree of confidence of the statistics, an estimation of the total area confined of 40% can be given (2 confined wells of 5).

Vulnerability:

Moderate. The geometric mean depth to static water level is 7.6 m (25 feet). The range of thickness of the confining layer in the well records ranges from 0 to 7.6 m (0 to 25 feet). The geometric mean thickness of the confining layer is 0.2 m (0.6 ft) and the median thickness of the confining layer is 0 m (0 ft). The permeability of the overlying formation is low. Low permeability clay was identified in only 2 wells of 5. High permeability gravel and sand were identified in 3 wells of 4. The aquifer has "windows" of highly permeable sediments in a clay confining layer.

Productivity:

Moderate. The well yields reported in the well records range from 0.6 to 0.9 L/s (10 to 15 USgpm). The geometric mean of reported well yields is 0.7 L/s (12 USgpm) and the median well yield is 0.7 L/s (11 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 7.6 m (25 ft). The median static water level is 5.5 m (18 ft) and the range of static water level is 4.9 to 22.6 m (16 to 74 ft).

Direction of Groundwater Flow:

The direction of the flow is eastward, following the topographic gradient.

Recharge:

The topography between the north bank of the Halfway River and the unconsolidated deposit is very steady. Recharge between the river and the aquifer varies from west to east. The construction of cross-sections has shown that the Halfway River feeds the aquifer in the western part. In the eastern part, the aquifer seems to feed the river. The well water level were observed at the same period of the year, so the season effect does not affect the observations.

Precipitation can be another source of recharge for this aquifer. Finally, a significant number of creeks (Grayling, Monteith, Cab, Cromie, etc…), flowing from the northern bedrock plateau towards the Halfway River could provide the aquifer in fresh water.

Domestic Well Density:

Very low. Approximately 0.17 wells/km^2.

Type of Water Use:

All the wells are reported as domestic.

Reliance on Source:

Well water is the only known source of water for domestic use. The available data for the well yields are however satisfying and Halfway River being a major stream, a quantity issue is not expected. Finally, Halfway River may be used for other purposes than domestic.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

A chemical analysis was available for on one well, reporting a high concentration of iron (1.7 mg/L).

Notes:

The geometric mean depth of water wells in the aquifer is 11.9 m (39 ft). The median depth of wells is 12.5 m (41 ft) and the range of well depths is from 4.5 to 28.3 m (15 to 93 ft).

The statistics quoted for this aquifer are based on a total of 5 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Yeager F.S. and Brown D.G. 1978. Map 1460A. *Surficial Geology of Charlie Lake, BC*. Geological Survey of Canada. NTS File 93 B.

Mathews W.H. 1978. *Quaternary Stratigraphy and Geomorphology of Charlie Lake (94A) Map Area, British Columbia*; Geological Survey of Canada. pp.12, 13.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Halfway River

AQUIFER REFERENCE NUMBER: 0908

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate (Moderate productivity and low demand).

Level of Vulnerability: Moderate (leaky confining material with sand "windows").

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	2
Area	2
Demand	1
Type of Use	2
Quantity	0
Quality	0
Total	**9**

Statistical Analysis of Well Data for Aquifer 0908

Total number of wells available for statistical analysis: **5**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	5	4	1	3	5
Maximum	93	74	21	15	25
Minimum	15	16	21	10	0
Average	46	32	N/A	12	6
Median	41	18	N/A	11	0
Geometric Mean	39	25	N/A	12	0.6

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

AQUIFER REFERENCE NUMBER: 0910

DESCRIPTIVE LOCATION OF AQUIFER: East of Williston Lake

NTS MAP SHEETS: 94 B 01 and 94 A 04

BCGS MAP SHEETS: 94 A 01 and 94 B 10

CLASSIFICATION: II B **RANKING VALUE: 11**

Aquifer Size:

Area of aquifer is approximately 36.1 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well record information and the geological map of the area.

The North-eastern boundary is defined and follows a major thrust/fault. The unconsolidated formation (where the aquifer exists) overlies the bedrock formation. The well log records show a sharp boundary with unconsolidated wells in the western part and bedrock wells on the eastern part.

Overall the boundaries are undefined and are drawn in such a way as to encompass all the unconsolidated wells recorded.

The boundaries may be extended westward and southward if more wells are drilled.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

Almost all the area is covered with lacustrine deposits. The south-western part of the area is identified as fluvial deposits, and the surficial geological map (1382A) shows a *major meltwater channel*, as well as *major terrace escarpments*.

Lacustrine deposits consist of clay, silt and sand and minor gravel near the former shorelines. The map legend indicates a thickness of the deposits generally over 3.6 m (12 ft). This is confirmed by the well log records analysis, showing a geometric mean of the confining thickness of 3 m (10 ft).

Fluvial deposits consist of undifferentiated gravel sand and silt.

Geologic Formation (aquifer):

The well log records indicate an unconsolidated formation of sand and gravel, probably comprised of fluvial deposits.

Confined / Partially Confined / Unconfined:

Confined by a thin and inhomogeneous layer of clay and silt.

Vulnerability:

Moderate. The geometric mean depth to static water level is 36.9 m (121 ft). The range of thickness of the confining layer in the well records ranges from 0 to 56 m (0 to 184 ft). The geometric mean thickness of the confining layer is 0.3 m (10 ft) and the median thickness of the confining layer is 10.4 (34 ft). The permeability of the overlying formation is low (clay and silt). However, 3 wells of 10 do not have a confining thickness. The aquifer has 3 windows of vulnerability reported.

Productivity:

Moderate. The well yields reported range up to 1.89 L/s (30 USgpm). The geometric mean and the median of reported well yield are respectively 0.82 L/s and 2.1 L/s (13 and 34 USgpm). The average of reported well yields is 4.29 L/s (68 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 36.9 m (121 ft). The median static water level is 65.8 m (216 ft) and the range of static water level is 8.5 to 73.1 m (28 to 240 ft).

Direction of Groundwater Flow:

The direction of the flow is eastward, following the topographic gradient. The surficial geology map (1382A) indicates a *major meltwater channel* within the boundaries of the aquifer, and an arrow pointing to the east confirms the flow direction to be eastward and northeastward.

Recharge:

Precipitation and water from Williston Lake. The meltwater channel reported on the map seems to be connected to the lake. Williston Lake could be the major source of recharge for this aquifer.

Domestic Well Density:

Low. Approximately 0.3 wells/km^2, or one well per 3.5 km^2.

Type of Water Use:

Seven wells of 10 are reported as domestic. One well of 10 is classified as *other* and 2 of 10 are unknown.

Reliance on Source:

Well water is the only known source for domestic use. There are no quantity problem reported and the yields of all the wells are sufficient. However, Williston Lake or Peace River may be used for other purposes than domestic.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented

Notes:

The geometric mean depth of water wells in the aquifer is 50.3 m (165 ft). The median depth of wells is 65.8 m (216 ft) and the range of well depths is from 12.5 to 115.8 m (41 to 380 ft).

The statistics quoted for this aquifer are based on a total of 10 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Barbary G. and Rutter N.W. 1974. Map 1382A. *Surficial Geology and Landforms of Williston Lake Area*, BC. Geological Survey of Canada.

Massey, N.W.D et Al., 2005. *Digital Geology Map of British Columbia: Whole Province.* Geoscience BC, Map 2009-4-1, scale 1:500,000.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: East of Williston Lake

AQUIFER REFERENCE NUMBER: 0910

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 11**

Classification Component:

Level of Development: Moderate (Moderate productivity and low demand).

Level of Vulnerability: Moderate (leaky confining material with sand "windows").

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	2
Area	3
Demand	1
Type of Use	3
Quantity concerns	0
Quality concerns	0
Total	**11**

Statistical Analysis of Well Data for Aquifer 0910

Total number of wells available for statistical analysis: **10**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	10	9	1	10	10
Maximum	380	240	34	30	184
Minimum	41	28	34	2	0
Average	197	150	N/A	17	68
Median	216	178	N/A	18	34
Geometric Mean	165	121	N/A	13	10

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 9, 2011

AQUIFER REFERENCE NUMBER: 0917

DESCRIPTIVE LOCATION OF AQUIFER: Near East Pine

NTS MAP SHEET: 93 P 11/14

BCGS MAP SHEET: 93 P 74

CLASSIFICATION: II B	RANKING: 9

Aquifer Size: Area of aquifer is approximately 58.4 km^2.

Aquifer Boundaries: The South-eastern boundary is defined by Pine River. The Western boundary follows a small creek until hitting the 780 m topographic line. The Northern boundary follows the 780 m topographic line and extends to the Pine River. The Western and Northern boundaries may be extended in the future if more wells are drilled.

Aquifer Type: Bedrock aquifer.

Geologic Formation (overlying material): Most of the area is covered by lacustrine deposits containing till, silt and clay. A band of alluvial deposits roughly follows the Pine River, and further, glaciofluvial deposits surround the alluvial deposits. The North-western part of the aquifer is covered by morainal deposits.

Lacustrine deposits consist of clay, silt, sand and minor gravel size material deposited in a standing body of water, largely fluviatile and/or glacial origin. Glaciofluvial deposits consist of detrital materials deposited by flowing glacial melt-water, composed of gravel and sand, with minor finer material and locally may contain till. Morainal deposits are heterogeneous assortment of clay to boulder size material, deposited directly from glacial ice (Reimchen, T.H.F., 1971).

Geologic Formation (aquifer): Dunvegan formation composed of massive conglomerate, fine to coarse-grained sandstone and carbonaceous shale.

Confined / Partially confined / Unconfined: Confined by till, silt and clay. One well record shows the bedrock formation at the surface (unconfined). A second well displays a window of high permeable sediments (sand and gravel) over a thickness of 72.2 m (237 ft).

Vulnerability: Moderate. The geometric mean depth to static water level is 27.4 m (90 ft). The range of thickness of the confining layer in the well records ranges from 0 to 53.3 m (0 to 175 ft). The geometric mean thickness of the confining layer is 5.2 m (17 ft) and the median thickness of the confining layer is 15.5 m (51 ft). The permeability of the overlying formation is low to medium. Low permeability clay and till were identified in 6 wells of 12. Low to medium permeability silt and till were identified in 4 wells of 12. High permeability sand and gravel were identified in 1 well of 12. One well record displays bedrock at the surface.

Productivity: Low. The well yields reported in the well records range from 0.03 to 9.46 L/s (0.5 to 150 USgpm). The geometric mean of the reported well yields is 0.25 L/s (4 USgpm) and the median well yield is 0.25 L/s (4 USgpm). The BC Ministry of Environment has no available test data to estimate the aquifer transmissivity and specific capacity values.

Depth to Water: The geometric mean static water level is 27.4 m (90 ft). The median static water level is 36.6 m (120 ft) and the range of static water level is 7 to 99 m (23 to 325 ft).

Direction of Groundwater Flow: The direction of the flow is north-eastward, following the topographic gradient.

Recharge: Precipitation. Water wells are recharged from direct infiltration of precipitation (rain and snow). The aquifer may also be recharged by leakage from the overlying geologic units if micro-fractures allow the water to reach the main fractures. Further studies are required to determine all sources of recharge to the aquifer.

Domestic Well Density: Light. Approximately 0.2 well/km^2 (14 wells of approximately 70 km^2).

Type of Water Use: Domestic and water supply system. Five wells out of 14 are reported as domestic. Five wells out of 14 are reported as water supply system. One well is abandoned and 3 wells are unknown.

Reliance on Source: Well water is the only known source of domestic and water supply system; however the Pine River may also be used as a drinking water source.

Conflicts Between Users: None documented.

Quantity Concerns: None documented.

Quality Concerns: None documented.

Comments: The geometric mean depth of water wells in the aquifer is 88.7 m (291 ft). The median depth of wells is 91.4 m (300 ft) and the range of well depths is from 41.1 to 153 m (135 to 502 ft).
The statistics quoted for this aquifer are based on a total of 14 well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater.* Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Reimchen, T.H.F., 1971. *Surficial Geology, Dawson Creek, British Columbia.* Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa, ON.

Massey, N.W.D et Al., 2005. *Digital Geology Map of British Columbia: Whole Province.* Geoscience BC, Map 2009-4-1, scale 1:500,000.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Near East Pine

AQUIFER REFERENCE NUMBER: 0917

AQUIFER TYPE: Bedrock

CLASSIFICATION: II B	**RANKING: 9**

Classification Component:

Level of Development: Moderate (Low productivity and low demand).

Level of Vulnerability: Moderate (highly confining material with windows of highly permeable materials).

Ranking Component:	*Ranking Value*
Productivity:	**1**
Vulnerability:	**2**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**0**
Quantity Concerns:	**0**
Total:	**9**

Statistical Analysis of Well Data for Aquifer 0917:

Total number of wells available for statistical analysis: **14**

	Well Depth (ft.)	**Depth to Water (ft.)**	**Depth to Bedrock (ft.)**	**Reported Est. Well Yield (USgpm)**	**Est. Thickness of Confining Materials (ft.)**
Number of Wells	14	9	13	10	12
Maximum	502	325	240	150	175
Minimum	135	23	0	0.2	0
Average	315	130	102	24	67
Median	300	120	98	4	51
Geometric Mean	291	90	49	4	17

AQUIFER CLASSIFICATION WORKSHEET

DATE: April 29, 2011

AQUIFER REFERENCE NUMBER: 0923

DESCRIPTIVE LOCATION OF AQUIFER: North East of Moberly Lake

NTS MAP SHEET: 93 P 13

BCGS MAP SHEET: 93 P 82/92/93

CLASSIFICATION: II C	RANKING: 11

Aquifer Size: Area of aquifer is approximately 61.8 km^2.

Aquifer Boundaries: The aquifer boundary was delineated using water well record information (area of well development) and surficial geology maps. The southern aquifer boundary is fixed by the lake shoreline. Further around the lake, several unconsolidated formations host small aquifers. However, they are considered to not belong to the main aquifer, because they occur 1n isolated alluvial fans.

The Eastern boundary is delimitated by the Moberly River.

The Western boundary is delimited by the topography and surficial geology. The abrupt change of topography at the bedrock formation allows a high degree of confidence for this boundary. The boundary is fixed at the 780 m topographic line.

The Northern limit is uncertain and only fixed because of a lack of information further north. This boundary may be modified in the future if more wells are drilled.

Aquifer Type: Uconsolidated aquifer.

Geologic Formation (overlying material): Most of the aquifer area is covered by eolian and morainal deposits. A band of alluvial deposits roughly follows the Moberly River. A large alluvial fan is found in the south-western part of the aquifer. Glaciofluvial deposits are located in the extreme southern part, along the lake. Eolian deposits consist of sands and silts transported by the wind action. Morainal deposits are heterogeneous assortment of clay to boulder size material, deposited directly from glacial ice. Glaciofluvial deposits consist of detrital materials deposited by flowing glacial melt-water, composed of gravel and sand, with minor finer material and locally may contain till.

Geologic Formation (aquifer): Glaciofluvial and lacustrine deposits composed of sand, gravel and silt.

Confined / Partially confined / Unconfined: Confined by leaky sediments. Windows of highly permeable sediments (gravel and sand) in the confining clay layer.

Vulnerability: Low. The geometric mean depth to static water level is 10.9 m (36 feet). The range of thickness of the confining layer in the well records ranges from 4 to 64 m (13 to 210 feet). The geometric mean thickness of the confining layer is 22.9 m (75 ft) and the median thickness of the confining layer is 23.8 m (78 ft). The permeability of the overlying formation is low to medium. Low permeability clay silt and till were identified in 13 wells of 15. Low to medium permeability silt and sand were identified in 2 wells of 15. One well doesn't have a confining layer.

Productivity: Moderate. The well yields reported in the well records range from 0.32 to 2.52 L/s (5 to 40 USgpm). The geometric mean of reported well yields is 0.62 L/s (10 USgpm) and the median well yield is 0.57 L/s (9 USgpm). The BC Ministry of Environment has no available test data to estimate the aquifer transmissivity and specific capacity values.

Depth to Water: The geometric mean static water level is 11 m (36 ft). The median static water level is 12.2 m (40 ft) and the range of static water level is 6.1 to 21.3 m (20 to 70 ft).

Direction of Groundwater Flow: The direction of the flow is northward, following the topographic gradient.

Recharge: The main sources of recharge to the aquifer are precipitation, runoff water coming from the west and probably the lake and river waters. At least three main runoff channels are evident, draining the high western plateaus. Many of the minor streams disappear when arriving on top of the aquifer. The lake is situated upstream from the aquifer.

Domestic Well Density: Light. Approximately 0.36 well/km^2 (15 wells for approximately 62 km^2).

Type of Water Use: Domestic and non-domestic. Most well use is reported as domestic (6 of 15), and one as non-domestic. Eight wells have no information on the use.

Reliance on Source: Well water is the only known source of domestic and water supply system; however the Moberly Lake and Moberly River may also be used as a drinking water source.

Conflicts Between Users: None documented.

Quantity Concerns: One dry well was reported (#59869). It is situated in the middle of the aquifer in the northern part, for a well depth of 61 m (200 ft). This well has one of the greatest confining thicknesses (51.2 m or 168 ft). Another well located less than a kilometer northward, yields 5 USgpm. Some clay lenses may be present in some specific areas of the aquifer.

Quality Concerns: The aquifer material appears highly oxidized in one well at the edge of the lake within the sand aquifer formation.

Comments: The geometric mean depth of water wells depth in the aquifer is 37.2 m (122 ft). The median depth of wells is 36.6 m (120 ft) and the range of well depths is from 14.9 to 147.2 m (49 to 483 ft).
The statistics quoted for this aquifer are based in a total of 15 well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Reimchen, T.H.F., 1971. Surficial Geology, Dawson Creek, British Columbia. Geological Survey of Canada, Map 1467A, scale 1:250,000. Ottawa, ON.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: North East of Moberly Lake

AQUIFER REFERENCE NUMBER: 0923

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II C	RANKING: 11

Classification Component:

Level of Development: Moderate (Moderate productivity and low demand).

Level of Vulnerability: Low (good confining material).

Ranking Component:	*Ranking Value*
Productivity:	**2**
Vulnerability:	**1**
Size:	**3**
Demand:	**1**
Type of Use:	**3**
Quality Concerns:	**1**
Quantity Concerns:	**0**
Total:	**11**

Statistical Analysis of Well Data for Aquifer 0923:

Total number of wells available for statistical analysis: **15**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	15	11	2	10	14
Maximum	483	70	130	40	210
Minimum	48.8	20	104	5	13
Average	147	39	117	13	94
Median	120	40	117	9	78
Geometric Mean	122	36	116	10	75

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 16, 2011

AQUIFER REFERENCE NUMBER: 0928

DESCRIPTIVE LOCATION OF AQUIFER: Lynx Creek and Peace River

NTS MAP SHEETS: 94 A 04

BCGS MAP SHEETS: 94 A 11/21

CLASSIFICATION: II B **RANKING VALUE: 9**

Aquifer Size:

Area of aquifer is approximately 37.4 km^2.

Aquifer Boundaries:

The aquifer boundaries are delineated in order to encompass the 8 wells belonging to a bedrock aquifer. The topography is undulating or hilly and no major river is close enough to constitute a defined boundary.

The boundaries may be extended in all the directions if more wells are drilled in the area.

Aquifer Type:

Bedrock aquifer.

Geologic Formation (overlying material):

Most of the aquifer is covered by glacial deposits. The extreme southern part is covered with glaciolacustrine deposits. The aquifer is located at about 20 km east of Williston Lake and about 7 km north of Peace River. The geometric mean of the thickness of the overlying formation is 15.8 m (52 ft).

Geologic Formation (aquifer):

The aquifer is located in the Fort St John Group. It is mostly composed of shale, interbedded with sandstone, siltstone and occasionally, conglomerates.

Confined / Partially Confined / Unconfined:

Confined by a low permeability clay formation.

Vulnerability:

Low. The depth to the water table is moderately shallow, with a geometric mean depth of 15.8 m (52 ft). The range of thickness of the confining layer in the well records range from 9.7 to 32.3 m (32 to 106 ft). The geometric mean thickness and the median of the confining layer are respectively 13.1 and 11 m (43 and 36 ft). The permeability overlying the formation is low (clay) and no windows of vulnerability have been reported. Moreover, the well depths are deep, ranging up to 71 m (233 ft), showing deep water-bearing fractures.

Productivity:

Low. The well yields reported in the wells recorded range up to 18.9 L/s (300 USgpm). The geometric mean and the median of reported well yields are respectively 0.38 L/s and 0.25 L/s (6 and 4 USgpm). The average of reported well yields is 2.9 L/s (46 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values. One well WTN 102511 is reported as 300 USgpm and was drilled by *Jacob's Water Wells*. The yield is suspect as Jacob's consistently reports the highest yields in many aquifers. Also, this well is the shallowest well in the aquifer.

Depth to Water:

The geometric mean static water level is 4.6 m (15 ft). The median static water level is 1.8 m (6 ft) and the range of static water level is to 1.5 to 34.7 m (5 to 114 ft).

Direction of Groundwater Flow:

The direction of the flow may follow the topography and the flow direction of the creeks around. Two major creeks are flowing southward towards Peace River. The discharge may occur toward the Peace River, and in this case would be southward. Further studies should be made to determine the direction of the flow with a better degree of confidence.

Recharge:

The recharge would occur mostly from precipitation. However, the undefined boundaries of the aquifer do not allow a good knowledge of the actual extent of the aquifer. This bedrock aquifer could in fact be more extended and could drain water from creeks to the north.

Domestic Well Density:

Low. Approximately 0.21 wells/km^2, or one well per 4.75 km^2.

Type of Water Use:

Five wells of 8 are reported as domestic. Three wells of 10 are classified as *other*.

Reliance on Source:

Well water is the only known source for domestic use. No further information is available to determine another source.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented

Notes:

The geometric mean depth of water wells in the aquifer is 48.2 m (158 ft). The median depth of wells is 53.3 m (175 ft) and the range of well depths is from 31 to 71 m (102 to 233 ft).

The statistics quoted for this aquifer are based on a total of 8 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Yeager F.S. and Brown D.G. 1978. Map 1460A. *Surficial Geology of Charlie Lake, BC*. Geological Survey of Canada. NTS File 93 B.

Massey, N.W.D et Al., 2005. Digital Geology Map of British Columbia: Whole Province. Geoscience BC, Map 2009-4-1, scale 1:500,000.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Lynx Creek and Peace River

AQUIFER REFERENCE NUMBER: 0928

AQUIFER TYPE: Bedrock

CLASSIFICATION: II B **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate (low productivity and low demand).

Level of Vulnerability: Low (good confining material and deep water-bearing fractures)

Ranking Component	*Ranking value*
Productivity	1
Vulnerability	1
Area	3
Demand	1
Type of Use	3
Quantity concerns	0
Quality concerns	0
Total	**9**

Statistical Analysis of Well Data for Aquifer 0928

Total number of wells available for statistical analysis: **8**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	8	3	8	8	7
Maximum	233	114	140	300	106
Minimum	102	5	32	1	32
Average	170	42	60	46	48
Median	175	6	43	4	36
Geometric Mean	158	15	52	6	43

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 17, 2011

AQUIFER REFERENCE NUMBER: 0929

DESCRIPTIVE LOCATION OF AQUIFER: North Pine River and Nelson Creek

NTS MAP SHEETS: 93 O 09

BCGS MAP SHEETS: 93 O 69/70

CLASSIFICATION: II B **RANKING VALUE: 9**

Aquifer Size:

Area of aquifer is approximately 10.4 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated by well development and the local quaternary geology.

The southern boundary follows the Pine River until the bedrock reaches the river on the eastern and western parts.

The northern boundary follows the boundary of the quaternary deposits, roughly matching with the topography. Bedrock is found right above the northern boundary.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

A thin confining layer of clay and silt covers the aquifer.

Geologic Formation (aquifer):

The aquifer occurs in terrace deposits, composed of gravel sheets, capped with sand or silt (W.H. Mathews, 1978).

Confined / Partially Confined / Unconfined:

Confined by a low permeability clay and silt formation.

Vulnerability:

Moderate. The depth to the water table is very shallow, with a geometric mean depth of 3.9 m (13 ft). The aquifer is non-artesian. The range of thickness of the confining layer in the well records range from 1.5 to 7.6 m (5 to 25 ft). The geometric mean thickness and the median of the confining layer are respectively 2.1 and 1.5 m (7 and 5 ft). The permeability overlying the formation is low (clay and silt) and no windows of vulnerability have been reported. The level of vulnerability is however considered as *moderate* because of the very thin confining layer.

Productivity:

Moderate. The well yields reported in the wells recorded range up to 2.52 L/s (40 USgpm). The geometric mean and the median of reported well yields are respectively 1 and 1.26 L/s (16 and 20 USgpm). The average of reported well yields is 1.39 L/s (22 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 3.9 m (13 ft). The median static water level is 3.6 m (12 ft) and the range of static water level is to 3 to 5.5 m (10 to 18 ft).

Direction of Groundwater Flow:

The direction of the flow is eastward, following the topographic gradient.

Recharge:

Precipitation and runoff. More than 10 creeks are mapped, draining water from the northern plateaus toward Pine River. Some of them disappear when arriving above the aquifer, showing that infiltration occurs.

Domestic Well Density:

Light. Approximately 0.16 wells/km^2, or one well per 6.25 km^2.

Type of Water Use:

Three wells of 4 are reported as domestic. One well of 4 is classified as *water supply system*.

Reliance on Source:

Well water is the only known source for domestic use. The Pine River may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented

Notes:

The geometric mean depth of water wells in the aquifer is 11.6 m (38 ft). The median depth of wells is 10.7 m (35 ft) and the range of well depths is from 4.9 to 40.2 m (16 to 132 ft).

The statistics quoted for this aquifer are based on a total of 4 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Mathews W.H. 1978. *Quaternary Stratigraphy and Geomorphology of Charlie Lake (94A) Map Area, British Columbia*; Geological Survey of Canada. pp.12.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: North Pine River and Nelson Creek

AQUIFER REFERENCE NUMBER: 0929

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: II B **RANKING VALUE: 9**

Classification Component:

Level of Development: Moderate (moderate productivity and low demand).

Level of Vulnerability: Moderate (thin confining thickness without windows of vulnerability and shallow water table).

Ranking Component	*Ranking value*
Productivity	2
Vulnerability	2
Area	2
Demand	1
Type of Use	2
Quantity concerns	0
Quality concerns	0
Total	**9**

Statistical Analysis of Well Data for Aquifer 0929

Total number of wells available for statistical analysis: **4**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	4	3	0	3	4
Maximum	132	18	N/A	40	25
Minimum	16	10	N/A	5	5
Average	55	13	N/A	22	10
Median	35	12	N/A	20	5
Geometric Mean	38	13	N/A	16	7

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 17, 2011

AQUIFER REFERENCE NUMBER: 0930

DESCRIPTIVE LOCATION OF AQUIFER: South of Pine River at Nelson Creek

NTS MAP SHEETS: 93 O 09

BCGS MAP SHEETS: 93 O 59/69/70

CLASSIFICATION: III A **RANKING VALUE: 12**

Aquifer Size:

Area of aquifer is approximately 16.7 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated by the well log records and the local quaternary geology.

The northern boundary follows the Pine River until the bedrock reaches the river in the eastern part.

The western boundary is defined by Beaudette Creek.

The southern boundary follows the boundary of the quaternary deposits, roughly matching with the topography. Bedrock formation is found right above the southern boundary.

Aquifer Type:

Unconsolidated aquifer.

Geologic Formation (overlying material):

A thin confining layer of clay and silt covers the aquifer.

Geologic Formation (aquifer):

The aquifer occurs in terrace deposits, composed of gravel sheets, capped with sand or silt (W.H. Mathews, 1978).

Confined / Partially Confined / Unconfined:

Partially confined by a low permeability clay and silt formation.

Vulnerability:

High. The depth to the water table is very shallow, with a geometric mean depth of 4 m (13 ft). The range of thickness of the confining layer in the well records range from 0 to 6.7 m (0 to 22 ft). The geometric mean thickness and the median of the confining layer are respectively 0.3 and 0.6 m (1 and 2 ft). The permeability overlying the formation is low (clay and silt) and 5 well recorded of 14, reported windows of vulnerability.

Productivity:

High. The well yields reported range up to 5 L/s (80 USgpm). The geometric mean and the median of reported well yields are respectively 4.23 and 4.42 L/s (67 and 70 USgpm). The average of reported well yields is 4.29 L/s (68 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 4 m (13 ft). The median static water level is 4.6 m (15 ft) and the range of static water level is 1.8 to 6.7 m (6 to 22 ft).

Direction of Groundwater Flow:

The direction of the flow is eastward, following the topographic gradient.

Recharge:

Precipitation and runoff. More than 10 creeks are mapped, draining water from the southern plateaus toward the Pine River. Some of them disappear when arriving above the aquifer, showing that infiltration occurs.

Domestic Well Density:

Light. Approximately 0.7 wells/km^2.

Type of Water Use:

Four of 12 wells are reported as domestic or municipal. Eight of 12 wells are for commercial and industrial use.

Reliance on Source:

Well water is the only known source for domestic use. The Pine River may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented

Notes:

The geometric mean depth of water wells in the aquifer is 13.4 m (44 ft). The median depth of wells is 11.3 m (37 ft) and the range of well depths is from 8.5 to 27.4 m (28 to 90 ft).

The statistics quoted for this aquifer are based on a total of 11 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Mathews W.H. 1978. *Quaternary Stratigraphy and Geomorphology of Charlie Lake (94A) Map Area, British Columbia*; Geological Survey of Canada. pp.12.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: South of Pine River at Nelson Creek

AQUIFER REFERENCE NUMBER: 0930

AQUIFER TYPE: Unconsolidated

CLASSIFICATION: III A **RANKING VALUE: 12**

Classification Component:

Level of Development: Light (high productivity and low demand)

Level of Vulnerability: High (thin confining thickness with windows of vulnerability and shallow water table).

Ranking Component	*Ranking value*
Productivity	3
Vulnerability	3
Area	2
Demand	1
Type of Use	3
Quantity concerns	0
Quality concerns	0
Total	**12**

Statistical Analysis of Well Data for Aquifer 0930

Total number of wells available for statistical analysis: **11**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	11	7	0	6	11
Maximum	90	22	N/A	80	22
Minimum	28	6	N/A	50	0
Average	47	14	N/A	68	4
Median	37	15	N/A	70	2
Geometric Mean	44	13	N/A	67	1

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 17, 2011

AQUIFER REFERENCE NUMBER: 0931

DESCRIPTIVE LOCATION OF AQUIFER: East of Blueberry River and North of Fort St John

NTS MAP SHEETS: 94 A 07 / 10 / 15 / 16

BCGS MAP SHEETS: 94 A 47 / 57 / 58 / 67 / 68 / 77 / 78 / 87 / 88 / 97 / 98 / 99

CLASSIFICATION: II B **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 964.4 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated by well development and the major rivers.

The western boundary follows Beatton River. The western bank of Beatton River hosts the bedrock aquifer 451. The Northwestern boundary follows Milligan Creek and reaches the Eastern boundary.

The eastern boundary follows Doig River.

Aquifer Type:

Bedrock aquifer.

Geologic Formation (overlying material):

Most of the aquifer is covered by thick glacial deposits. All the western part is covered with glacio-lacustrine deposits and the eastern part along Doig River is covered with fluvioglacial deposits. The southern part of the aquifer, in a large extent around the Doig and Beatton Rivers is a valley fill.

Glacial deposits consist of till and stony silty clay, locally including thin lacustrine material. Glacio-lacustrine deposits consist of clay, silt, minor sand and shoreline gravel. It is reported to be generally thicker than 6 feet. Fluvioglacial deposits consist of gravel and sand. Valley fill consists of gravel, sand, silt and clay, generally underlying glacio-lacustrine deposits (Map 1460A – Charlie Lake).

Geologic Formation (aquifer):

Shale and sandstone of the Dunvegan formation, Upper Cretaceous Period of the Mesozoic Era. The Dunvegan formation consists mainly of fine-grained finely laminated and cross bedded sandstones. Coarse-grained sandstone and conglomerate as well as carbonaceous shale also occur within the formation (Stott, 1961).

Bedrock lithology is primarily described on well records as *sandstone and shale interbeds* while thick formations of clay are often described to exist between the sandstone and shale formations. The clay may be misinterpreted by the driller on some well records and is likely a *clay shale* or *mudstone*. The clay is also commonly described on well records as *heavy*. Shale is commonly described as layered (laminated) with clay interbeds. Conglomerate has *not* been reported on well records.

A few deeper wells to the north could be completed within the underlying marine shales of the Fort St. John formation but the contact between these formations has not been specifically noted on well records. It is also possible that hydraulic continuity exists between the deeper Fort St. John and the overlying Dunvegan formation and these formations behave hydraulically as a *single* aquifer system. The marine shales of the underlying Fort St. John formation exist at a depth of approximately 152.4 m (500 ft) and one well (094A.067.4.4.4 - #81621) may intersect the Fort St John formation.

Confined / Partially Confined / Unconfined:

Confined with clay, till and silt.

Vulnerability:

Moderate. The depth to the water table has a geometric mean of 43.6 m (143 ft). The range of thickness of the confining layer in the well records range from 0 to 54.9 m (0 to 180 ft). The geometric mean thickness and the median of the confining layer are respectively 7 to 15.8 m (23 and 52 ft). The permeability overlying the formation is low (clay, till and silt). One well of 10 reported a window of vulnerability.

Productivity:

Low. The well yields reported in the wells range up to 1.26 L/s (20 USgpm). The geometric mean and the median of reported well yields are respectively 0.38 and 0.5 L/s (6 and 8 USgpm). The average of reported well yields is 0.5 L/s (8 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 43.6 m (143 ft). The median static water level is 37.2 m (122 ft) and the range of static water level is to 26.2 to 115.8 m (86 to 380 ft).

Direction of Groundwater Flow:

The direction of the flow is eastward, following the topographic gradient.

Recharge:

Water wells are likely recharged from direct infiltration of precipitation (rain and snow) at ground surface.

Domestic Well Density:

Low. There is approximately 1 well per 95 km^2.

Type of Water Use:

Most water well use reported is domestic although one well reports water use as industrial/commercial.

Reliance on Source:

Well water is the only known source for domestic use. The Beatton and Doig Rivers may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented

Notes:

The geometric mean depth of water wells in the aquifer is 85.3 m (283 ft). The median depth of wells is 79.8 m (262 ft) and the range of well depths is from 28.3 to 262.1 m (93 to 860 ft).

The statistics quoted for this aquifer are based on a total of 10 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Mathews W.H. 1978. *Quaternary Stratigraphy and Geomorphology of Charlie Lake (94A) Map Area, British Columbia*; Geological Survey of Canada. pp.12.

Stott, D.F., 1982. Bulletin 328. *Lower Cretaceous Fort St. John Group and Upper Cretaceous Dunvegan Formation of the Foothills and Plains of Alberta, British Columbia, District of Mackenzie and Yukon Territory*. Geological Survey of Canada.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: East of Blueberry River and North of Fort St John

AQUIFER REFERENCE NUMBER: 0931

AQUIFER TYPE: Bedrock

CLASSIFICATION: II B **RANKING VALUE: 10**

Classification Component:

Level of Development: Moderate (low productivity and low demand).

Level of Vulnerability: Moderate (limited natural protection against contamination from the surface)

Ranking Component	*Ranking value*
Productivity	1
Vulnerability	2
Area	3
Demand	1
Type of Use	3
Quantity concerns	0
Quality concerns	0
Total	**10**

Statistical Analysis of Well Data for Aquifer 0931

Total number of wells available for statistical analysis: **10**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	10	6	10	7	8
Maximum	860	380	192	20	180
Minimum	93	86	0	2	0
Average	342	167	74	8	57
Median	262	122	71	8	52
Geometric Mean	283	143	35	6	23

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 18, 2011

AQUIFER REFERENCE NUMBER: 0932

DESCRIPTIVE LOCATION OF AQUIFER: Wonowon, between Blueberry and Cameron Rivers.

NTS MAP SHEETS: 94 A 12

BCGS MAP SHEETS: 94 A 71/72

CLASSIFICATION: II B **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 23 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well development and the topography. They follow the 900 m topographic line, surrounding the city of Wonowon.

Aquifer Type:

Bedrock aquifer.

Geologic Formation (overlying material):

The area is entirely covered by glacial deposits of the last glaciation. They consist of till and stony silty clay, locally including thin and patchy cover of lacustrine material (Yeager and Brown, 1978, Map 1460A).

Geologic Formation (aquifer):

Shale and sandstone of the Dunvegan formation, Upper Cretaceous Period of the Mesozoic Era. The Dunvegan formation consists mainly of fine-grained finely laminated and cross bedded sandstones. Coarse-grained sandstone and conglomerate as well as carbonaceous shale also occur within the formation (Stott, 1961).

Bedrock lithology is primarily described on well records as sandstone and shale interbeds while thick formations of clay are often described to exist between the sandstone and shale formations. The clay may be misinterpreted by the driller on some well records and is likely a clay shale or mudstone. The clay is also commonly described on well records as heavy. Shale is commonly described as layered (laminated) with clay interbeds. Conglomerate has not been reported on well records.

Confined / Partially Confined / Unconfined:

Confined with clay, and a small amount of till and silt.

Vulnerability:

Moderate. The depth to the water table has a geometric mean of 22.9 m (75 ft). The range of thickness of the confining layer in the well records range from 0 to 42 m (0 to 138 ft). The geometric mean thickness and the median of the confining layer are respectively 4.9 to 4.5 m (16 and 15 ft). The permeability overlying the formation is low (clay, till and silt). One well of 31 reported a window of vulnerability where the bedrock locally emerges at the surface.

Productivity:

Low. The well yields reported in the wells recorded range up to 1.14 L/s (18 USgpm). The geometric mean and the median of reported well yields are respectively 0.28 and 0.35 L/s (4.4 and 5.5 USgpm). The average of reported well yields is 0.44 L/s (7 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 22.9 m (75 ft). The median static water level is 25.9 m (85 ft) and the range of static water level is to 1.2 to 79.2 m (4 to 260 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty. The map shows a topographic dome around Wonowon. Numerous creeks flow from the plateau of Wonowon in all directions toward the closest surrounding rivers. The aquifer occurs between two major rivers: Cameron on the western side and Blueberry on the northeastern side. The hypothesis that the general flow direction of the groundwater is the same as the flow direction of the river could be taken into consideration, Cameron River being at a little bit further than a kilometer away from the aquifer western boundary. Moreover, the general static water level from the well log records appears to be higher than the level of the Cameron River (15.5 m or 51 ft higher). In this configuration, the aquifer feeds the river, with the direction of the groundwater flow towards the river. However, the measurement could have been taken during a high water level period (wet season). The available data does not allow a conclusion of the opposite configuration (river feeding the aquifer) exists.

Overall, the complexity of a fractured environment such as this one does not allow determination of this question with a reasonable degree of confidence.

Recharge:

Precipitation and maybe infiltration from the river if low water level season exist (see section *Direction of the Groundwater Flow*).

Domestic Well Density:

Low. There is approximately 1.3 well per km^2.

Type of Water Use:

Most water well use reported is domestic although one well reports water use as industrial/commercial.

Reliance on Source:

Well water is the only known source for domestic use.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

Two well records (94A.071.2.4.2-3 #17953 and #104356) report a poor quantity.

Quality Concerns (type, source, level of concern):

None. One well record however reports a *rusty colored* water.

Notes:

The geometric mean depth of water wells in the aquifer is 54.2 m (178 ft). The median depth of wells is 47.2 m (155 ft) and the range of well depths is from 18.3 to 146.3 m (60 to 480 ft).

The statistics quoted for this aquifer are based on a total of 32 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Yeager F.S. and Brown D.G. 1978. Map 1460A. *Surficial Geology of Charlie Lake, BC*. Geological Survey of Canada. NTS File 93 B.

Stott, D.F., 1982. Bulletin 328. *Lower Cretaceous Fort St. John Group and Upper Cretaceous Dunvegan Formation of the Foothills and Plains of Alberta, British Columbia, District of Mackenzie and Yukon Territory*. Geological Survey of Canada.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: City of Wonowon, between Blueberry and Cameron Rivers.

AQUIFER REFERENCE NUMBER: 0932

AQUIFER TYPE: Bedrock

CLASSIFICATION: II B **RANKING VALUE: 10**

Classification Component:

Level of Development: Moderate (low productivity and low demand).

Level of Vulnerability: Moderate (good natural protection against contamination from the surface)

Ranking Component	*Ranking value*
Productivity	1
Vulnerability	2
Area	2
Demand	1
Type of Use	3
Quantity concerns	1
Quality concerns	0
Total	**10**

Statistical Analysis of Well Data for Aquifer 0932

Total number of wells available for statistical analysis: **31**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	31	25	31	20	31
Maximum	480	260	150	18	138
Minimum	60	4	0	0	0
Average	201	91	33	7	29
Median	155	85	15	6	15
Geometric Mean	178	75	17	4	16

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 18, 2011

AQUIFER REFERENCE NUMBER: 0933

DESCRIPTIVE LOCATION OF AQUIFER: Cecil Lake, North of Peace River

NTS MAP SHEETS: 94 A 01 / 02 / 07 / 08 / 09

BCGS MAP SHEETS: 94 A 19 / 20 / 28 / 29 / 37 / 40 / 48 / 49 / 58

CLASSIFICATION: II B **RANKING VALUE: 13**

Aquifer Size:

Area of aquifer is approximately 1119.6 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well log records and the geographical elements, such as deep river valleys. The southern boundary of the aquifer follows the Peace River.

The eastern boundary follows the Alces River and the Western boundary follows Beatton River. The aquifer is bordered on its southwestern side by the bedrock aquifer 451 and on the northwestern boundary by the bedrock aquifer 931.

The northern boundary is undefined and follows La Guarde Creek and reaches Alces River.

Aquifer Type:

Bedrock aquifer.

Geologic Formation (overlying material):

The Southern part of the area, along Peace River and the western boundary are covered by valley fill. Most part of the area in the centre is covered by glacio-lacustrine deposits, generally less than 6 feet thick. The northeastern part of the area is covered by glacial deposits and the eastern boundary displays glacio-lacustrine deposits, generally more than 6 feet thick.

Valley fill consist of gravel, sand, silt and clay and generally underlay glacio-lacustrine deposits. Glacio-lacustrine deposits consist of silt and stony silty clay, with minor sand and shoreline gravel. Glacial deposits consist of till and stony silty clay, locally including thin and patchy cover of lacustrine material. (Yeager and Brown, 1978, Map 1460A).

Geologic Formation (aquifer):

The aquifer is mostly located in shale and sandstone of the Dunvegan formation, Upper Cretaceous Period of the Mesozoic Era. The Dunvegan formation consists mainly of fine-grained finely laminated and cross bedded sandstones. Coarse-grained sandstone and conglomerate as well as carbonaceous shale also occur within the formation (Stott, 1961).

The bedrock geology map shows that all the eastern part is covered by the Smokey Group, composed of sandstone and carbonaceous shale. Although this formation has to be taken in consideration, it appears very thin, since washed out around the Alces River and some other creeks. The Smokey Group may become thicker going north-eastward, but the majority of the wells are located on the western part, in the vicinity of Fort St John. The estimation of the Smokey Group thickness in this area gives a maximum value of 100 m (328 ft). If the Smokey Group remains thin in most of the aquifer, the exploited fractures may belong only to the subjacent Dunvegan Formation.

There are not major geological differences between the Dunvegan Formation and the Smokey Group, and it is reasonable to consider that the two formations are hydrogeologically connected.

Confined / Partially Confined / Unconfined:

Confined with clay and till.

Vulnerability:

Moderate. The depth to the water table has a geometric mean of 20.7 m (68 ft). The range of thickness of the confining layer in the well records range from 0 to 119.2 m (0 to 391 ft). The geometric mean thickness and the median of the confining layer are respectively 13.7 to 23.5 m (45 and 77 ft). The permeability overlying the formation is low (clay, till and silt). Three wells of 47 reported a window of vulnerability where the bedrock locally emerges at the surface.

Productivity:

Low. The well yields reported range up to 1.58 L/s (25 USgpm). The geometric mean and the median of reported well yields are respectively 0.32 and 0.32 L/s (5 and 5 USgpm). The average of reported well yields is 0.44 L/s (7 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 20.7 m (68 ft). The median static water level is 20.4 m (67 ft) and the range of static water level is to 3.6 to 84.1 m (12 to 276 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty. The aquifer is localized between two main rivers (Beatton and Alces) flowing southward to Peace River. The groundwater flow may follow the same direction, but more studies are required to determine this point with accuracy.

Recharge:

Direct infiltration from the precipitation and maybe infiltration from the Beatton and Alces Rivers.

Domestic Well Density:

Low. There is approximately one well for 12.6 km^2.

Type of Water Use:

Most water well use reported is domestic although several well report an industrial/commercial use.

Reliance on Source:

Well water is the only known source for domestic use, however, Peace Beatton and Alces Rivers may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

Local quantity concerns, found in a significant portion of the aquifer. The well log records have indicated 4 major dry zones. The biggest one is in the eastern part of the aquifer, just below Cecil Lake, and would extend over 25 km^2.

Quality Concerns (type, source, level of concern):

One isolated quality concern has been reported. The well #46268 reports a concentration of iron of 30 ppm. The limit fixed in the *Guidelines for Canadian Water Quality* is fixed at 0.3 ppm. This well reports a value 100 times over the acceptable limit.

Notes:

The presence of dry zones within the aquifer should not exempt the oil and gas companies from adopting all the security measures as if it was in a normal aquifer. In fact, those dry zones are expected to connect to the aquifer and potentially transmit any kind of pollution. However, for a matter of well development for drinking water, these areas are a poor target.

The geometric mean depth of water wells in the aquifer is 50.6 m (193 ft). The median depth of wells is 46.6 m (199 ft) and the range of well depths is from 6 to 146.3 m (25 to 1216 ft).

The statistics quoted for this aquifer are based on a total of 47 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Yeager F.S. and Brown D.G. 1978. Map 1460A. *Surficial Geology of Charlie Lake, BC.* Geological Survey of Canada. NTS File 93 B.

Massey, N.W.D et Al., 2005. *Digital Geology Map of British Columbia: Whole Province.* Geoscience BC, Map 2009-4-1, scale 1:500,000.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Cecil Lake, North of Peace River

AQUIFER REFERENCE NUMBER: 0933

AQUIFER TYPE: Bedrock

CLASSIFICATION: II B **RANKING VALUE: 13**

Classification Component:

Level of Development: Moderate (low productivity and low demand).

Level of Vulnerability: Moderate (windows of vulnerability into clay/till confining thickness.)

Ranking Component	*Ranking value*
Productivity	1
Vulnerability	2
Area	3
Demand	1
Type of Use	3
Quantity concerns	2
Quality concerns	1
Total	**13**

Statistical Analysis of Well Data for Aquifer 0933

Total number of wells available for statistical analysis: **47**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	47	22	44	32	44
Maximum	1216	276	390	25	391
Minimum	25	12	0	1	0
Average	253	102	106	7	99
Median	199	67	84	5	77
Geometric Mean	193	68	56	5	45

AQUIFER CLASSIFICATION WORKSHEET

DATE: May 19, 2011

AQUIFER REFERENCE NUMBER: 0934

DESCRIPTIVE LOCATION OF AQUIFER: Between Halfway and Cameron Rivers

NTS MAP SHEETS: 94 B 10

BCGS MAP SHEETS: 94 B 59

CLASSIFICATION: II A **RANKING VALUE: 10**

Aquifer Size:

Area of aquifer is approximately 58.3 km^2.

Aquifer Boundaries:

The aquifer boundaries were delineated using the well log records, the topography and the rivers. The southern boundary follows the Cameron River until hitting the southeastern part the boundaries of the unconsolidated aquifer 908. The bedrock aquifer starts where the slopes get steep. Even in the absence of information, the flat terraces on both sides of the river are considered to potentially host unconsolidated aquifers.

The eastern boundary is delineated by Aikman Creek.

The northern boundary follows a little creek westward until hitting the 860 m topographic line.

The western boundary follows a little creek until reaching Halfway River.

The boundaries may be extended, but only 4 wells are reported in this aquifer. A reasonable perimeter has to be established around those wells.

Aquifer Type:

Bedrock aquifer.

Geologic Formation (overlying material):

No surficial geology map is available for this area. We can only rely on the well log records, reporting an average overlying thickness of 6 m (20 ft). Three wells of 4 report unconsolidated materials composed of sand, and medium to coarse gravel. One well of 4 reports 6.7 meters (22 ft) of till.

Geologic Formation (aquifer):

The aquifer is located in the Fort St. John Group unit of the Lower Cretaceous. It is mostly composed of shale, interbedded with sandstone, siltstone/mudstone and conglomerates. Its maximum thickness in the Peace River Region is estimated to range around 850 m (2780 ft).

Confined / Partially Confined / Unconfined:

Partially confined to unconfined. Three wells of 4 do not show a confining thickness. However, due to the large extent of the aquifer and the small number of wells, it is hard to decide between partially confined or unconfined. Moreover, the only well record reporting a confining thickness of till does not give the water depth. It is then impossible to say if in this part the aquifer is artesian or not.

Vulnerability:

High. The depth to the water table has a geometric mean of 8.2 m (27 ft). The range of thickness of the confining layer in the well records range from 0 to 6.7 m (0 to 22 ft). The geometric mean thickness and the median of the confining layer are respectively 0.12 to 0.03 m (0.4 and 0.1 ft). The permeability overlying the formation present in only one well is low (till). Three wells of 4 are do not report any confining layer. The unconsolidated material above the bedrock is mostly reported as sand and gravel.

Productivity:

Low. The well yields reported in the wells recorded range up to 0.44 L/s (7 USgpm). The geometric mean and the median of reported well yields are respectively 0.38 and 0.38 L/s (6 and 6 USgpm). The average of reported well yields is 0.38 L/s (6 USgpm). The BC Ministry of Environment has no available test data to estimate the transmissivity and specific capacity values.

Depth to Water:

The geometric mean static water level is 8.2 m (27 ft). The median static water level is 9.1 m (30 ft) and the range of static water level is to 5.5 to 12.5 m (18 to 41 ft).

Direction of Groundwater Flow:

Unknown, insufficient data available to determine with certainty. However, the groundwater could follow the topographic gradient to feed the Halfway River. In this case, the direction would be southward, but more studies are required to determine this point with accuracy.

Recharge:

Direct infiltration from precipitation and maybe infiltration from the several creeks running off above the aquifer.

Domestic Well Density:

Low. There is approximately one well for 15 km^2.

Type of Water Use:

All the wells report a domestic use.

Reliance on Source:

Well water is the only known source for domestic use, however, Halfway River may be used for other purposes than drinking water.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

None documented.

Notes:

The geometric mean depth of water wells in the aquifer is 28 m (92 ft). The median depth of wells is 27.1 m (89 ft) and the range of well depths is from 12.5 to 70.1 m (41 to 230 ft).

The statistics quoted for this aquifer are based on a total of 4 water well records.

References:

Berardinucci, J. and Ronneseth, K. 2002. *Guide to using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, BC. 54 pp.

Massey, N.W.D et Al., 2005. *Digital Geology Map of British Columbia: Whole Province.* Geoscience BC, Map 2009-4-1, scale 1:500,000.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Between Halfway and Cameron Rivers

AQUIFER REFERENCE NUMBER: 0934

AQUIFER TYPE: Bedrock

CLASSIFICATION: II A **RANKING VALUE: 10**

Classification Component:

Level of Development: Moderate (low productivity and low demand).

Level of Vulnerability: High (most well records report no confining thickness)

Ranking Component	*Ranking value*
Productivity	1
Vulnerability	3
Area	3
Demand	1
Type of Use	2
Quantity concerns	0
Quality concerns	0
Total	**10**

Statistical Analysis of Well Data for Aquifer 0934

Total number of wells available for statistical analysis: **4**

	Well Depth (ft.)	Depth to Water (ft.)	Depth to Bedrock (ft.)	Reported Est. Well Yield (USgpm)	Est. Thickness of Confining Materials (ft.)
Number of Wells	4	2	4	2	4
Maximum	230	41	30	7	22
Minimum	41	18	10	5	0
Average	112	30	20	6	6
Median	89	30	19	6	0.1
Geometric Mean	92	27	18	6	0.4