

Appendix IV

July 19, 2021
File: 123221643

Attention: Diana Fausto
Bureau Veritas Laboratory
4606 Canada Way
Burnaby, BC V5G 1K5

Dear Diana,

Reference: Quinsam Lakes Phytoplankton, May 2021 (Sample Reference ZS7968-11, ZS7969-02, ZS7940-11, ZS7906-11, and ZS7934-11; Job Numbers C129542, C129531, C129518, and C129528)

Introduction

Quinsam Coal Ltd. collects water samples from the Quinsam Lakes system during the growing season to meet long-term water quality monitoring requirements as per the effluent discharge permit issued by the Ministry of Environment and Climate Change Strategy. From 1994 through 2012, the permit required sampling at depths of 1, 4 and 9 m in April through September for Long Lake and Middle Quinsam Lake, with No Name Lake added to the program in June 2012 and Lower Quinsam Lake added in 2013. In 2014 the permit was revised to include surface water sampling (1.0 m depth) three times a year (spring, late summer, fall overturn). Attachment 1 contains the long-term dataset.

Samples are collected by Quinsam Coal and submitted to Stantec Consulting Ltd. for phytoplankton taxonomic analysis, as part of ongoing monitoring requirements. Some months, an additional sample is taken as a field replicate for quality assurance/quality control. This brief report provides information about samples collected in May 2021 from Long Lake (two samples), Middle Quinsam Lake, No Name Lake, and Lower Quinsam Lake.

Methods

Sub-samples (27 mL) of preserved lake water were settled and examined at 100 X, 400 X and 1,000 X magnifications using a Zeiss inverted microscope. Counting effort is defined as at least 100 organisms of the predominant species at 400 X, up to 200 fields at 1,000 X and a half or whole sub-sample at 100 X.

Reference: Quinsam Lakes Phytoplankton, May 2021 (Sample Reference ZS7968-11, ZS7969-02, ZS7940-11, ZS7906-11, and ZS7934-11; Job Numbers C129542, C129531, C129518, and C129528)

Results

Abundance

Abundance data for 1993 to 2020 are summarized in Attachment 1 and detailed taxonomic results for May 2021 are presented in Attachment 2.

Total abundance in the May samples is shown in Table 1. Total abundance for May was 1,000 and 1,200 cells/mL for the two Long Lake sample, 2,200 cells/mL for the Middle Quinsam Lake sample, 1,200 cells/mL for the No Name Lake sample, and 1,300 cells/mL for the Lower Quinsam Lake sample. These numbers are in the range reported historically.

Table 1 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2021

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May 4	1,000	920	120	1.7
Long (replicate)		1,200	1,100	120	0.7
Middle Quinsam		2,200	2,100	120	0.1
No Name ¹		1,200	990	220	0.2
Lower Quinsam		1,300	1,100	180	1.8
NOTE:					
^{1.} <i>Dinobryon</i> spp. counted at 400X rather than 100X due to high abundance					

Species Composition

Species composition data for the May 2021 samples are contained in Attachment 2. The most abundant phytoplankton in Long, Middle Quinsam, No Name, and Lower Quinsam lakes were the very small (less than or equal to 5 µm) chrysoflagellates (*Ochromonas* spp. and *Chromulina* spp.). Although these ultra-nanoplankton species were very abundant numerically, they usually contribute little to algal biomass.

The most abundant of the larger algae were as follows:

- In Long Lake (both samples), larger *Ochromonas* spp. were predominant, with the cryptophyte *Rhodomonas minuta* common. The large dinoflagellate *Ceratium hirudinella* was also present; this species more typically occurs during the summer.
- In Middle Quinsam Lake, larger *Ochromonas* spp. were predominant, with other taxa not present in sufficient numbers to be considered common.

Reference: Quinsam Lakes Phytoplankton, May 2021 (Sample Reference ZS7968-11, ZS7969-02, ZS7940-11, ZS7906-11, and ZS7934-11; Job Numbers C129542, C129531, C129518, and C129528)

- In No Name Lake, larger *Ochromonas* spp. were predominant, with the cryptophytes *Rhodomonas minuta* and *Cryptomonas* spp. common.
- In Lower Quinsam Lake, larger *Ochromonas* spp. were predominant, with the cryptophytes *Rhodomonas minuta* and *Cryptomonas* common.

The May 2021 samples were similar in composition and abundance to samples collected during the spring in recent years.

Comparison of Replicate Samples

Two replicates were collected from 1 m depth in Long Lake. Percent difference in the duplicate samples was calculated. A difference of up to 10% can be expected for a total cell count of 400 organisms, for repeat sampling from the same bottle; higher percent difference can be expected when separate grabs are used for the replicates, as was done here.

The replicate samples were similar in species composition and in abundance (1,000 cells/mL in one sample and 1,200 cells/mL in the other); this difference of $\pm 18\%$ indicates reasonable inter-sample reproducibility, given that samples were taken from different bottles.

Closure

We trust this information meets your present requirements. Should you have any questions or require additional information, please contact the undersigned.

Regards,

Stantec Consulting Ltd.

Karen Munro M.Sc., R.P.Bio.
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Attachments: Attachment 1: Historical Abundance Data: Quinsam Lakes System, 1993–2020
Attachment 2: Species Composition Data: May, 2021
Attachment 3: Chain of Custody: May, 2021

September 29, 2021

File: 123221643

Attention: Diana Fausto

Bureau Veritas Laboratory
4606 Canada Way
Burnaby, BC V5G 1K5

Dear Diana,

Reference: Quinsam Lakes Phytoplankton, July 2021 (Sample Reference ABQ010, ABQ011, and ABQ030; Job Numbers C149515 and C149519)

Introduction

Quinsam Coal Ltd. collects water samples from the Quinsam Lakes system during the growing season to meet long-term water quality monitoring requirements as per the effluent discharge permit issued by the Ministry of Environment and Climate Change Strategy. From 1994 through 2012, the permit required sampling at depths of 1, 4 and 9 m in April through September for Long Lake and Middle Quinsam Lake, with No Name Lake added to the program in June 2012 and Lower Quinsam Lake added in 2013. In 2014 the permit was revised to include surface water sampling (1.0 m depth) three times a year (spring, late summer, fall overturn). Attachment 1 contains the long-term dataset.

Samples are collected by Quinsam Coal and submitted to Stantec Consulting Ltd. for phytoplankton taxonomic analysis, as part of ongoing monitoring requirements. Some months, an additional sample is taken as a field replicate for quality assurance/quality control. This brief report provides information about samples collected in July 2021 from Long Lake (two samples) and Middle Quinsam Lake.

Methods

Sub-samples (27 mL) of preserved lake water were settled and examined at 100 X, 400 X and 1,000 X magnifications using a Zeiss inverted microscope. Counting effort is defined as at least 100 organisms of the predominant species at 400 X, up to 200 fields at 1,000 X and a half or whole sub-sample at 100 X.

Reference: Quinsam Lakes Phytoplankton, July 2021 (Sample Reference ABQ010, ABQ011, and ABQ030; Job Numbers C149515 and C149519)

Results

Abundance

Abundance data for 1993 to 2020 are summarized in Attachment 1 and detailed taxonomic results for July 2021 are presented in Attachment 2.

Total abundance in the May and July samples is shown in Table 1. Total abundance for July was 1,000 cells/mL for the two Long Lake samples and 1,400 cells/mL for the Middle Quinsam Lake sample. These numbers are in the range reported historically.

Table 1 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2021

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May 4	1,000	920	120	1.7
Long (replicate)		1,200	1,100	120	0.7
Middle Quinsam		2,200	2,100	120	0.1
No Name ¹		1,200	990	220	0.2
Lower Quinsam		1,300	1,100	180	1.8
Long	July 12	1,000	830	190	0.9
Long (replicate)		1,000	810	190	0.4
Middle Quinsam		1,400	1000	390	0.2
NOTE:					
^{1.} <i>Dinobryon</i> spp. counted at 400X rather than 100X due to high abundance					

Species Composition

Species composition data for the July 2021 samples are contained in Attachment 2. The most abundant phytoplankton in Long and Middle Quinsam lakes were the very small (less than or equal to 5 µm) chrysoflagellates (*Ochromonas* spp. and *Chromulina* spp.). Although these ultra-nanoplankton species were very abundant numerically, they usually contribute little to algal biomass.

September 29, 2021

Diana Fausto

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Reference: Quinsam Lakes Phytoplankton, July 2021 (Sample Reference ABQ010, ABQ011, and ABQ030; Job Numbers C149515 and C149519)

The most abundant of the larger algae were as follows:

- In Long Lake (both samples), the colonial green alga *Dictyosphaerium pulchellum* was predominant and larger *Ochromonas* spp. were common.
- In Middle Quinsam Lake, the colonial green alga *Dictyosphaerium pulchellum* was predominant and larger *Ochromonas* spp. and colonial green alga *Gloeocystis* sp. were common.

The July 2021 samples were similar in composition to samples collected during the spring in recent years.

Comparison of Replicate Samples

Two replicates were collected from 1 m depth in Long Lake. Percent difference in the duplicate samples was calculated. A difference of up to 10% can be expected for a total cell count of 400 organisms, for repeat sampling from the same bottle; higher percent difference can be expected when separate grabs are used for the replicates, as was done here.

The replicate samples were similar in species composition and in abundance (1,000 cells/mL in both samples); this difference in abundance indicates reasonable inter-sample reproducibility.

Closure

We trust this information meets your present requirements. Should you have any questions or require additional information, please contact the undersigned.

Regards,

Stantec Consulting Ltd.

Karen Munro

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Attachments: Attachment 1: Historical Abundance Data: Quinsam Lakes System, 1993–2020
Attachment 2: Species Composition Data: July, 2021
Attachment 3: Chain of Custody: July, 2021

November 1, 2021

File: 123221643

Attention: Diana Fausto

Bureau Veritas Laboratory

4606 Canada Way

Burnaby, BC V5G 1K5

Dear Diana,

Reference: Quinsam Lakes Phytoplankton, October 2021 (Sample Reference AHQ993, AHQ959, and AHQ960; Job Numbers C175998 and C175993)

Introduction

Quinsam Coal Ltd. collects water samples from the Quinsam Lakes system during the growing season to meet long-term water quality monitoring requirements as per the effluent discharge permit issued by the Ministry of Environment and Climate Change Strategy. From 1994 through 2012, the permit required sampling at depths of 1, 4 and 9 m in April through September for Long Lake and Middle Quinsam Lake, with No Name Lake added to the program in June 2012 and Lower Quinsam Lake added in 2013. In 2014 the permit was revised to include surface water sampling (1.0 m depth) three times a year (spring, late summer, fall overturn). Attachment 1 contains the long-term dataset.

Samples are collected by Quinsam Coal and submitted to Stantec Consulting Ltd. for phytoplankton taxonomic analysis, as part of ongoing monitoring requirements. Some months, an additional sample is taken as a field replicate for quality assurance/quality control. This brief report provides information about samples collected in October 2021 from Long Lake and Middle Quinsam Lake (two samples).

Methods

Sub-samples (27 mL) of preserved lake water were settled and examined at 100 X, 400 X and 1,000 X magnifications using a Zeiss inverted microscope. Counting effort is defined as up to 200 fields at 1,000 X, at least 100 organisms of the predominant species at 400 X, and a half or whole sub-sample at 100 X.

Reference: Quinsam Lakes Phytoplankton, October 2021 (Sample Reference AHQ993, AHQ959, and AHQ960; Job Numbers C175998 and C175993)

Results

Abundance

Abundance data for 1993 to 2020 are summarized in Attachment 1 and detailed taxonomic results for October 2021 are presented in Attachment 2.

Total abundance in the May, July, and October samples is shown in Table 1. Total abundance for October was 2,100 cells/mL for the Long Lake sample and 2,200 cells/mL for the two Middle Quinsam Lake samples. These numbers are in the range reported historically.

Table 1 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2021

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May 4	1,000	920	120	1.7
Long (replicate)		1,200	1,100	120	0.7
Middle Quinsam		2,200	2,100	120	0.1
No Name ¹		1,200	990	220	0.2
Lower Quinsam		1,300	1,100	180	1.8
Long	July 12	1,000	830	190	0.9
Long (replicate)		1,000	810	190	0.4
Middle Quinsam		1,400	1000	390	0.2
Long	October 6	2,100	1,900	190	0.4
Middle Quinsam		2,200	2,000	200	12.6
Middle Quinsam replicate)		2,200	2,000	230	11.4
NOTE:					
¹ . <i>Dinobryon</i> spp. counted at 400X rather than 100X due to high abundance					

Species Composition

Species composition data for the October 2021 samples are contained in Attachment 2. The most abundant phytoplankton in Long and Middle Quinsam lakes were the very small (less than or equal to 5 µm) chrysoflagellates (*Ochromonas* spp. and *Chromulina* spp.). Although these ultra-nanoplankton species were very abundant numerically, they usually contribute little to algal biomass.

November 1, 2021

Diana Fausto

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Reference: Quinsam Lakes Phytoplankton, October 2021 (Sample Reference AHQ993, AHQ959, and AHQ960; Job Numbers C175998 and C175993)

The most abundant of the larger algae were as follows:

- In Long Lake, the cryptophyte *Rhodomonas minuta* was predominant and larger *Ochromonas* spp. and *Mallomonas* spp. were common.
- In Middle Quinsam Lake (both samples), larger *Ochromonas* spp., and *Rhodomonas minuta* were predominant and the colonial chrysophyte *Dinobryon cylindricum* was common.

The October 2021 samples were similar in composition to samples collected during the fall in recent years.

Comparison of Replicate Samples

Two replicates were collected from 1 m depth in Middle Quinsam Lake. Percent difference in the duplicate samples was calculated. A difference of up to 10% can be expected for a total cell count of 400 organisms, for repeat sampling from the same bottle; higher percent difference can be expected when separate grabs are used for the replicates, as was done here.

The replicate samples were similar in species composition and in abundance (2,200 cells/mL in both samples); this similarity indicates reasonable inter-sample reproducibility.

Closure

We trust this information meets your present requirements. Should you have any questions or require additional information, please contact the undersigned.

Regards,

Stantec Consulting Ltd.

Karen Munro

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Attachments: Attachment 1: Historical Abundance Data: Quinsam Lakes System, 1993–2020
Attachment 2: Species Composition Data: October, 2021
Attachment 3: Chain of Custody: October, 2021

ATTACHMENT 1
Historical Abundance Data:
Quinsam Lakes System, 1993–2020

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-1 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1993 and 1994

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
1993 October	LLM1	2,300	1,800	530	
	LLM3	3,000	2,400	550	
	LLMB	610	420	190	
1994 May	LL1R	10,000	8,800	1,200	
	LL3R	5,000	3,800	1,200	
	LL9R	4,000	3,200	800	
1994 June	LL0	1,400	1,200	250	
	LL1	1,000	790	220	
	LL4	1,500	1,200	320	
	LL9	2,500	1,900	580	
	LLB	830	440	390	
1994 July	LL1	2,100	1,900	180	
	LL4	1900	1700	250	
	LL9	1,500	1,100	400	
1994 August	LL1	1,700	1,400	290	
	LL4	1,000	850	200	
	LL9	900	780	150	
1994 September	LL1	900	620	250	
	LL4	2,300	2,000	260	
	LL9	2,100	1,700	350	

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-2 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1995**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	3,100	2,700	340	
	LL4	3,300	2,900	350	
	LL9	1,300	1,100	280	
May	LL1	5,400	4,900	570	
	LL4	4,800	4,100	700	
	LL9	1,500	1,000	500	
June	LL1	2,100	1,800	300	
	LL4	2,600	2,100	500	
	LL9	7,400	6,600	850	
July	LL1	2,000	1,700	300	
	LL4	1,900	1,650	350	
	LL9	1,500	1,200	300	
August	LL1	1,100	960	180	
	LL4	1,300	1,100	240	
	LL9	1,900	1,700	210	
September	LL1	2,900	2,800	170	
	LL4	3,400	3,100	330	
	LL9	1,900	1,600	280	

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-3 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1996**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	4,600	4,200	340	
	LL4	6,000	5,600	380	
	LL9	1,100	960	160	
May	LL1	2,200	1,600	600	31
	LL4	2,200	1,700	540	16
	LL9	1,700	1,400	290	26
June	LL1	2,100	1,600	440	4
	LL4	1,600	1,300	340	2
	LL9	1,600	1,100	500	9
July	LL1	2,400	2,300	140	1
	LL4	3,200	3,000	200	3
	LL9	No sample			
August	LL1	2,100	1,900	160	1
	LL4	2,200	1,800	390	37
	LL9	1,700	1,500	200	10
September	LL1	1,900	1,600	230	82
	LL4	2,200	1,800	300	145
	LL9	2,100	1,800	220	38
April	MQ1	No sample			
	MQ4	No sample			
	MQ9	No sample			
May	MQ1	2,000	1,700	230	11
	MQ4	1,100	930	180	7
	MQ9	2,200	1,800	430	1
June	MQ1	2,700	2,500	150	3
	MQ4	2,600	2,400	210	7
	MQ9	1,200	1,000	190	1
July	MQ1	2,400	2,100	335	24
	MQ4	1,900	1,400	380	130
	MQ9	1,200	860	320	29
August	MQ1	2,800	2,500	280	17
	MQ4	1,800	1,500	310	18
	MQ9	2,300	1,900	390	21
September	MQ1	1,700	1,300	270	5
	MQ4	900	560	350	0.6
	MQ9	1,200	1,100	190	0.7

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-4 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1997**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
early May	LL1	3,200	2,800	340	12
	LL4	4,300	4,000	300	32
	LL9	1,700	1,600	140	5
late May ¹	LL1	3,000	2,600	370	61
	LL4	4,900	4,200	620	100
	LL9	4,700	4,000	730	44
June ²	LL1	1,500	1,100	340	2
	LL4	1,200	1,000	240	1
	LL9	3,900	2,700	1,200	50
July	LL1	2,400	2,300	110	0
	LL4	1,700	1,500	170	0.1
	LL9	480	390	80	2
August	LL1	1,900	1,700	230	0.2
	LL4	880	740	140	0.6
	LL9	1,000	870	93	1.4
September	LL1	1,000	870	140	0.6
	LL4	2,000	1,800	270	0.3
	LL9	700	490	210	0.8
early May	MQ1	1,700	1,400	270	2
	MQ4	1,600	1,400	240	2
	MQ9	2,500	2,300	240	2
late May	MQ1	1,200	1,000	150	0.4
	MQ4	1,600	1,300	280	1
	MQ9	1,200	1,000	190	0.2
June	MQ1	1,900	1,700	140	1
	MQ4	2,500	2,400	130	1
	MQ9	1,400	1,200	200	1
July	MQ1	2,400	2,300	130	0.3
	MQ4	1,500	1,400	110	0.1
	MQ9	890	640	260	0.6
August	MQ1	2,100	1,900	220	0.8
	MQ4	1,500	1,300	190	1.4
	MQ9	1,000	760	240	1.6
September	MQ1	800	640	170	1.3
	MQ4	900	620	280	6.4
	MQ9	650	370	280	1.5
NOTES: 1. Recalculated counting <i>Synedra radians</i> at 400X rather than 100X 2. Recalculated counting <i>Synedra radians</i> at 400X rather than 100X & <i>Cyclotella glomerata</i> at 1,000X rather than 400X					

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-5 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1998**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	2,800	2,600	210	12
	LL4	4,100	3,700	390	12
	LL9	1,600	1,100	500	10
May ¹	LL1	2,000	1,500	430	76
	LL4	1,600	1,100	480	85
	LL9	2,100	1,500	630	20
June	LL1	5,700	5,600	140	0.3
	LL4	7,100	6,900	210	0.3
	LL9	3,300	1,700	1,600	4
July	LL1	1,200	1,100	130	10
	LL4	740	560	170	8
	LL9	760	130	630	5
August	LL1	1,900	1,700	190	2
	LL4	2,200	2,000	230	2
	LL9	1,900	1,600	220	5
September	LL1	5,000	4,900	130	2
	LL4	3,500	3,300	150	2
	LL9	2,200	2,000	220	5
April	MQ1	2,200	1,900	250	3
	MQ4	1,900	1,600	260	3
	MQ9	3,100	2,700	460	2
May	MQ1	2,500	2,300	210	1
	MQ4	2,600	2,400	180	2
	MQ9	2,100	1,700	480	0.4
June	MQ1	1,900	1,700	180	1
	MQ4	1,600	1,400	200	1
	MQ9	1,300	1,000	310	0.4
July	MQ1	1,500	1,400	120	19
	MQ4	1,800	1,600	150	35
	MQ9	1,300	1,100	190	25
August	MQ1	1,900	1,700	250	12
	MQ4	1,300	950	350	10
	MQ9	1,400	890	490	12
September	MQ1	2,000	1,800	200	11
	MQ4	2,700	2,500	220	7
	MQ9	2,100	1,900	230	10
NOTE:					
1. Recalculated for counting <i>Synedra radians</i> at 400X rather than 100X					

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-6 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1999**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	3,800	3,500	310	9
	LL4	6,800	6,200	560	17
	LL9	3,000	2,600	410	10
May	LL1	No sample			
	LL4	No sample			
	LL9	No sample			
early July	LL1	1,100	910	150	2
	LL4	1,400	1,200	150	1
	LL9	1,300	1,200	100	1
late July	LL1	1,100	870	200	1
	LL4	2,000	1,800	280	1
	LL9	1,000	860	130	1
August	LL1	2,700	2,500	180	2
	LL4	2,800	2,600	170	6
	LL9	3,000	2,800	170	4
September	LL1	3,700	3,500	230	12
	LL4	5,000	4,700	290	17
	LL9	4,000	3,700	290	3
April	MQ1	2,300	1,600	220	430
	MQ4	2,200	1,800	200	230
	MQ9	2,700	1,900	600	190
May	MQ1	No sample			
	MQ4	No sample			
	MQ9	No sample			
early July	MQ1	790	700	90	0.4
	MQ4	770	620	150	0.5
	MQ9	1,100	1,000	130	0.3
late July	MQ1	2,700	2,600	110	0.2
	MQ4	2,100	1,900	220	0.8
	MQ9	620	420	190	0.3
August	MQ1	2,100	2,000	140	6
	MQ4	1,100	980	110	4
	MQ9	1,100	1,000	120	9
September	MQ1	1,300	1,100	190	14
	MQ4	1,500	1,300	190	9
	MQ9	760	540	210	10

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-7 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2000**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	2,100	1,600	450	33
	LL4	2,500	1,800	700	68
	LL9	1,300	590	740	6.8
May	LL1	3,300	2,800	530	17
	LL4	3,000	2,600	320	15
	LL9	2,000	1,500	490	15
June	LL1	2,900	2,500	390	9.1
	LL4	2,900	2,400	400	19
	LL9	6,400	5,700	730	19
July	LL1	1,600	1,400	130	2.1
	LL4	1,400	1,200	250	1.6
	LL9	1,200	990	250	3.6
August	LL1	1,800	1,600	170	12
	LL4	1,100	940	190	8.2
	LL9	1,500	1,400	130	1.9
September	LL1	2,200	1,900	360	11
	LL4	2,000	1,800	200	9.2
	LL9	1,300	1,100	200	7.2
April	MQ1	1,800	1,300	450	5.9
	MQ4	1,700	1,300	420	1.6
	MQ9	1,500	1,200	280	1.7
May	MQ1	1,800	1,500	290	3
	MQ4	1,600	1,300	290	4.4
	MQ9	1,900	1,600	270	7.6
June	MQ1	2,100	1,900	250	1.4
	MQ4	2,400	2,200	200	2.1
	MQ9	1,800	1,500	380	1.1
July	MQ1	1,300	1,100	210	7.4
	MQ4	2,100	1,800	250	9.6
	MQ9	2,100	1,300	800	22
August	MQ1	1,500	1,200	290	5.8
	MQ4	2,200	1,900	310	7.2
	MQ9	2,400	1,900	500	7.5
September	MQ1	1,800	1,600	200	14
	MQ4	2,100	1,900	250	14
	MQ9	2,000	1,700	220	28

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-8 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2001**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	3,300	2,600	670	19
	LL4	4,400	3,900	830	13
	LL9	1,400	860	490	5
May	LL1	7,700	6,200	1,100	310
	LL4	11,000	10,000	980	100
	LL9	4,600	3,600	670	22
June	LL1	7,800	6,600	1,000	170
	LL4	6,800	5,100	1,500	210
	LL9	3,000	2,400	680	25
July	LL1	3,300	3,100	170	1
	LL4	3,200	3,000	180	1
	LL9	1,600	1,400	160	2
August	LL1	1,300	1,100	180	1
	LL4	1,700	1,500	200	2
	LL9	720	540	170	1
September	LL1	8,200	8,000	270	13
	LL4	8,800	8,600	260	13
	LL9	4,800	4,600	190	1
April	MQ1	3,600	3,200	400	10
	MQ4	3,500	3,200	310	11
	MQ9	5,700	4,900	830	24
May	MQ1	1,900	1,500	360	17
	MQ4	1,800	1,400	370	14
	MQ9	3,800	3,200	600	13
June	MQ1	2,200	1,900	240	2
	MQ4	3,700	3,400	310	2
	MQ9	4,000	3,600	390	4
July	MQ1	2,500	2,300	230	8
	MQ4	2,700	2,400	260	6
	MQ9	1,500	1,200	240	8
August	MQ1	1,800	1,600	190	17
	MQ4	1,900	1,700	180	15
	MQ9	1,800	1,600	160	16
September	MQ1	1,900	1,700	180	24
	MQ4	3,200	2,900	230	37
	MQ9	1,800	1,600	190	43

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-9 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2002**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	5,600	5,100	460	57
	LL4	5,600	5,100	490	40
	LL9	1,300	1,100	220	12
May	LL1	2,600	1,900	710	29
	LL4	2,700	2,000	690	41
	LL9	1,800	1,300	460	37
June	LL1	5,800	5,300	340	140
	LL4	9,200	8,600	450	96
	LL9	3,700	3,000	620	27
July	LL1	2,900	2,700	180	0.3
	LL4	2,400	2,200	160	0.6
	LL9	3,900	3,300	560	41.2
August	LL1	2,900	2,800	140	7.2
	LL4	2,300	2,200	150	3.2
	LL9	1,500	1,400	130	0.6
September	LL1	3,900	3,700	220	27
	LL4	3,500	3,200	260	31
	LL9	2,500	2,300	210	2.2
April	MQ1	2,000	1,700	360	8.2
	MQ4	1,900	1,600	300	3.6
	MQ9	1,500	1,200	260	4
May	MQ1	1,400	1,100	270	1.1
	MQ4	1,400	1,200	230	1.7
	MQ9	1,400	1,100	330	1.4
June	MQ1	1,000	940	110	1
	MQ4	800	680	120	0.3
	MQ9	60	50	7	0
July	MQ1	1,700	1,300	330	50
	MQ4	1,500	1,100	360	34
	MQ9	940	700	240	5.5
August*	MQ1	1,400	1,200	140	42
	MQ4	1,200	940	180	76
	MQ9	2,600	200	300	275
September	MQ1	1,400	1,200	160	33
	MQ4	2,100	1,900	220	28
	MQ9	1,100	920	160	28
NOTE:					
* Recalculated for counting <i>Cyclotella bodanica</i> at 400X rather than 100X					

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-10 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2003**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	4,800	4,200	560	36
	LL4	3,600	2,900	640	8.6
	LL9	640	450	190	6.9
May	LL1	4,200	3,500	620	25
	LL4	4,600	3,800	800	23
	LL9	1,400	1,100	280	16
June	LL1	2,300	1,600	630	37
	LL4	6,800	6,100	600	43
	LL9	4,500	3,800	680	42
July	LL1	1,600	1,400	240	1
	LL4	2,400	2,100	270	0.5
	LL9	2,900	2,700	250	9.8
August	LL1	2,000	1,800	240	0.8
	LL4	2,200	1,900	250	0.5
	LL9	1,900	1,600	260	0.6
September	LL1	2,600	2,400	290	0.2
	LL4	3,700	3,400	340	1.8
	LL9	1,900	1,600	250	1.9
April	MQ1	3,500	2,900	570	28
	MQ4	3,000	2,400	510	17
	MQ9	2,000	1,600	310	17
May	MQ1	2,900	2,400	350	99
	MQ4	3,000	2,400	480	43
	MQ9	3,000	2,500	560	16
June	MQ1	1,300	1,100	180	6
	MQ4	1,900	1,500	420	21
	MQ9	3,000	2,700	350	16
July	MQ1	2,700	2,600	170	0.5
	MQ4	2,000	1,600	380	1.5
	MQ9	1,400	1,100	240	79
August	MQ1	1,300	1,000	280	43
	MQ4	1,500	1,200	240	44
	MQ9	3,500	2,500	620	338
September	MQ1	2,100	1,900	260	6.5
	MQ4	2,300	2,000	290	23
	MQ9	Not available			

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-11 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2004**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	5,300	4,100	1,200	20
	LL4	3,500	2,600	860	13
	LL9	3,300	2,600	730	9.1
May	LL1	8,000	7,100	860	34
	LL4	6,600	5,300	1,200	36
	LL9	2,800	2,000	770	22
June	LL1	2,900	2,600	270	3.1
	LL4	2,900	2,600	310	5
	LL9	4,900	4,100	730	39
July	LL1	1,600	1,300	280	2.7
	LL4	1,200	1,100	170	2.2
	LL9	1,700	1,400	270	1
August	LL1	1,300	960	350	18
	LL4	1,400	1,000	300	38
	LL9	1,700	1,600	110	27
September	LL1	3,800	3,400	370	27
	LL4	4,300	3,900	350	25
	LL4 - duplicate	3,100	2,800	320	19
	LL9	3,000	2,700	280	12
April	MQ1	1,500	1,120	400	2.2
	MQ4	1,400	1,030	370	5.2
	MQ9	1,500	1,200	340	4.2
May	MQ1	2,300	2,000	310	2.4
	MQ4	1,500	1,200	300	3.6
	MQ9	2,600	2,100	470	2.4
June	MQ1	1,900	1,700	190	34
	MQ4	3,000	2,700	250	48
	MQ9	2,200	1,900	210	123
July*	MQ1	1,200	960	260	6.2
	MQ4	1,700	1,400	260	9.9
	MQ9	1,300	840	340	82
August**	MQ1	2,900	2,600	260	53
	MQ4	3,800	3,500	250	51
	MQ4 - duplicate	2,500	2,200	210	53
September	MQ9	3,900	3,600	260	44
	MQ1	2,300	1,700	550	25
	MQ4	2,100	1,600	420	26
	MQ9	2,500	2,000	520	19

NOTES:

* MQ9 recalculated for counting *Cyclotella bodanica* at 400X rather than 100X

** MQ1, MQ4, MQ9 recalculated for counting *Elakatothrix gelatinosa* colonies at 400X rather than

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-12 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2005**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	2,700	2,100	550	24
	LL4	3,500	2,800	610	29
	LL9	670	460	200	8.5
May	LL1	7,200	6,600	670	55
	LL4	5,700	4,900	850	20
	LL9	1,300	850	440	20
June	LL1	2,700	2,400	300	2.4*
	LL4	2,800	2,500	330	8.3*
	LL9	990	850	130	8.9
July	LL1	1,200	800	400	44*
	LL4	1,700	1,200	460	33*
	LL9	692	540	150	3.5*
August	LL1	1,400	1,100	290	26
	LL4	1,100	810	220	64
	LL9	2,400	1,900	360	73
September	LL1	1,400	1,100	170	170
	LL4	2,300	1,900	220	170
	LL9	1,800	1,200	590	31*
April	MQ1	1,400	1,100	370	8.8
	MQ4	1,900	1,500	400	3.6
	MQ9	1,700	1,300	400	6.6
May	MQ1	1,300	1,000	300	3.4
	MQ4	1,500	1,200	330	3.2
	MQ9	1,300	1,000	340	3.7
June	MQ1	1,700	1,600	150	4.6
	MQ4	1,000	710	270	2.1
	MQ9	1,100	900	200	1.1
July ¹	MQ1	1,100	860	220	14.6
	MQ4	1,100	920	200	11.2
	MQ9	1,400	700	170	489
August ²	MQ1	1,100	950	170	0.5
	MQ4	1,900	1,600	250	7.1
	MQ9	2,100	1,700	330	89*
September	MQ1	870	710	140	10.7
	MQ4	1,200	1,100	170	20.2
	MQ9	1,400	1,100	180	146
NOTE:					
* = <i>Cyclotella bodanica</i> counted at 400X rather than 100X					

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-13 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2006**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	1,800	1,100	610	1.9*
	LL4	3,200	2,700	520	14.7
	LL9	690	550	135	2.2
May	LL1	2,600	2,000	620	19.7
	LL4	4,900	4,200	640	12.9
	LL9	540	380	160	4.8
June	LL1	860	610	200	39.5
	LL4	2,000	1,800	190	22.2
	LL4 (rep)	1,100	940	190	23.2
	LL9	1,700	1,400	220	17.7
July	LL1	1,300	1,100	160	54.8
	LL4	2,700	2,200	370	165
	LL9	1,700	1,300	350	19.1
August	LL1	2,700	2,500	200	14.3
	LL4	2,600	2,300	220	34.6
	LL9	2,800	2,300	470	23.8
September	LL1	3,800	3,600	160	0.4
	LL4	1,300	1,200	120	2
	LL9	1,800	1,700	130	3.6
April	MQ1	2,200	16,00	240	9.4
	MQ4	2,400	1,900	550	8.6
	MQ9	1,600	1,400	180	8.2
May	MQ1	1,700	1,500	240	10.8
	MQ4	1,700	1,400	320	7.4
	MQ4 (rep)	2,100	1,800	310	11.8
	MQ9	1,900	1,600	280	4.1
June	MQ1	1,900	1,800	130	0.9
	MQ4	1,400	1,200	200	4.4
	MQ9	950	840	110	0.6
July	MQ1	1,100	870	220	42.8
	MQ4	2,000	1,700	260	16.6
	MQ9	2,300	2,100	180	18.8*
August	MQ1	1,500	1,200	280	6.5
	MQ4	2,100	1,800	290	13.3
	MQ9	1,300	880	400	17.0*
September	MQ1	2,500	2,300	200	1.9
	MQ4	2,100	1,800	260	11.8
	MQ9	3,400	2,400	970	1.8*
NOTE:					
* <i>Cyclotella bodanica</i> (diatom) counted at 400X rather than 100X					

Table 1-14 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2007**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)
April	LL1	3,100	2,800	240
	LL4	3,000	2,200	620
	LL9	1,200	910	240
May	LL1	2,600	2,000	540
	LL4	3,300	2,600	670
	LL9	1,300	890	430
June	LL1	2,100	1,600	420
	LL4	2,500	2,000	520
	LL9	1,100	750	300
July	LL1	2,300	2,000	240
	LL4	2,400	2,100	270
	LL9	3,100	3,000	180
August	LL1	1,100	900	240
	LL4	2,300	2,100	150
	LL4 (rep)	2,600	2,400	150
	LL9	570	480	90
September	LL1	2,500	2,200	280
	LL4	1,700	1,400	240
	LL9	420	350	68
April	MQ1	1,700	1,500	230
	MQ4	1,900	1,602	300
	MQ9	1,100	900	200
May	MQ1	1,500	1,300	250
	MQ4	1,800	1,500	320
	MQ9	2,600	2,300	310
June	MQ1	1,500	1,200	300
	MQ4	1,800	1,600	200
	MQ9	1,500	1,200	290
July	MQ1	1,500	1,100	220
	MQ4	1,900	1,500	440*
	MQ9	1,000	860	150
	MQ9 (rep)	1,600	1,400	150
August	MQ1	2,300	2,100	200
	MQ4	1,100	970	160
	MQ9	710	590	120
September	MQ1	1,400	1,100	270
	MQ4	1,500	1,200	290
	MQ9	1,000	690	300

Table 1-15 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2008

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	>25 mm (100X)	> 25 µm (100X)
April	LL1	2,500	2,070	360	13	30
	LL4	3,100	2,500	540	22	50
	LL9	1,300	1,030	240	6.4	20
May	LL1	3,100	2,840	220	36	20
	LL4	5,300	4,820	430	37	25
	LL9	1,300	1,030	260	11	20
June	LL1	1,000	880	110	40	1
	LL4	960	730	220		8
	LL9 (rep)	1,500	1,060	380*	40	16*
	LL9	1,200	780	380*	10	7*
July	LL1	1,000	970	80	2.1	1
	LL4	1,400	1,300	110	7.8	17
	LL9	2,000	1,500	370	4.2	110
August	LL1	1,100	1,000	50	5.6	1
	LL4	1,400	1,300	50	5.8	11
	LL9	1,100	1,060	40	2.8	9
September	LL1	2,100	1,730	420**	16	2**
	LL4	2,300	1,780	490**	13	3**
	LL9	2,900	2,250	690**	4.4	6**
April	MQ1	2,100	1,850	200	2.8	1
	MQ4	1,700	1,530	200	5.8	3
	MQ9	2,800	2410	400	5	4
May	MQ1	1,000	870	130	2.1	1
	MQ4	1,700	1460	230	1.2	2
	MQ9	1,200	1,000	180	2.7	2
June	MQ1	840	700	140	2.9	0.4
	MQ4	1,300	1,040	240	2.1	1
	MQ9	870	580	280	5.8	0.5
July	MQ1	620	520	90	180	8
	MQ4	500	370	130	7.4	8
	MQ9	870	680	180	3.3	0.5
	MQ9 (rep)	1,000	760	260	0.8	9
August	MQ1	750	660	100	5.8	1
	MQ4	980	860	110	14	6
	MQ9	1,300	990	290		5
September	MQ1	1,500	1,310	160		14
	MQ4	1,100	980	150		3
	MQ9	2,800	2,680	130		10

NOTES:
 * *Synedra radians* (diatom) counted at 400X rather than 100X, due to high numbers
 ** *Asterionella formosa* (diatom) counted at 400X rather than 100X, due to high numbers

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-16 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2009**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	780	480	300	6
	LL4	1,600	1,220	340	4
	LL9	90	60	30	1
May	LL1	6,000	5,150	820	19
	LL4	4,900	4,100	760	10
	LL9	430	290	140	5
June	LL1	1,700	1,370	370	5
	LL4	1,400	1,030	360	12
	LL9	680	340	330	6
July	LL1	2,100	1,900	270	3
	LL4	2,700	2,400	330	4
	LL9	700	340	350	4
August	LL1	3,100	2,900	170	3
	LL4	2,400	2,200	190	15
	LL9	1,700	1,300	370	10
September	LL1	3,700	3,500	220	5
	LL4	2,300	2,100	180	3
	LL9	1,100	950	170	1
April	MQ1	1,400	1,130	250	33
	MQ4	1,300	1,170	160	12
	MQ9	2,300	2,730	520	13
May	MQ1	1,700	1,440	260	3
	MQ4	2,100	1,750	340	5
	MQ9	3,800	3,060	720	18
June	MQ1	1,500	1,360	160	0.1
	MQ4	1,100	990	150	0.2
	MQ9	1,100	940	200	0.8
July	MQ1	1,000	790	190	4
	MQ4	1,300	1,100	220	8
	MQ9	1,200	940	240	5
August	MQ1	610	450	160	0.3
	MQ4	1,300	1,170	170	3
	MQ9	1,600	1,200	390	0.4
September	MQ1	830	670	160	5
	MQ4	1,200	970	170	6
	MQ9	1,400	1,200	240	1

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-17 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2010**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	630	490	140	1.6
	LL4	1,900	1,500	390	3
	LL9	170	100	70	0.4
May	LL1	1,200	940	270	13.4
	LL4	4,500	3,800	650	17
	LL9	530	390	140	0.9
June	LL1	2,400	1,900	500	5.2
	LL4	3,600	3,000	610	11
	LL9	1,500	1,100	400	10.6
July	LL1	2,100	1,900	170	8.7
	LL1 (rep)	1,900	1,700	180	5
	LL4	3,000	2,800	250	2
	LL9	1,900	1,700	210*	0
August	LL1	1,200	990	180	1.5
	LL4	1,600	1,400	190	1
	LL4 (rep)	1,600	1,400	180	2
	LL9	1,800	1,600	170	0
September	LL1	2,100	1,800	260	15.1
	LL4	4,400	4,200	200	5
	LL9	1,200	1,100	130	0.4
April	MQ1	1,700	1,600	100	0.4
	MQ4	1,200	1,100	120	1
	MQ9	800	710	90	2.4
May	MQ1	1,100	990	120	0.9
	MQ4	1,100	960	150	1
	MQ9	1,600	1,330	240	2.9
June	MQ1	2,000	1,700	270	0.9
	MQ4	1,400	1,100	240	1
	MQ9	1,000	850	200	1.1
July	MQ1	1,800	1,500	250	8.7
	MQ1 (rep)	1,400	1,300	170	6
	MQ4	1,500	1,300	180	10
	MQ9	1,600	1,400	180	4
August	MQ1	1,400	1,200	140	7.2
	MQ4	1,000	870	160	5
	MQ4 (rep)	1,100	900	150	5
	MQ9	1,200	1,000	150	8
September	MQ1	1,300	1,000	260	1.3
	MQ4	1,300	1,040	220	3
	MQ9	1,100	900	190	1.7

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-18 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2011**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	1,700	1,400	220	52
	LL4	3,900	3,260	540	80
	LL9	2,200	1,820	340	9
May	LL1	3,600	2,880	720	6
	LL1 (rep)	3,500	2,790	690	6
	LL4	4,900	4,160	700	6
	LL9	1,300	900	350	5
June	LL1	2,100	1,750	330	36
	LL4	2,300	2,050	290	3
	LL9	1,500	1,060	450	4
July	LL1	1,400	1,150	270	3
	LL4	1,800	1,440	350	1
	LL4 (rep)	1,900	1,600	300	0.1
	LL9	1,900	1,550	320	2
August	LL1	2,900	2,500	360	15
	LL4	1,800	1,400	320	27
	LL9	1,500	1,200	280	0.9
September	LL1	1,300	940	380	2.2
	LL4	1,800	1,500	380	0.4
	LL9	960	770	190	0.3
April	MQ1	1,600	1,370	270	7
	MQ4	1,400	1,160	270	6
	MQ9	1,900	1,400	490	3
May	MQ1	1,200	1,050	190	2
	MQ1 (rep)	1,200	1,040	170	3
	MQ4	1,800	1,370	410	4
	MQ9	1,600	670	920	4
June	MQ1	2,000	1,840	150	1
	MQ4	1,500	1,300	200	1
	MQ9	1,700	1,200	520	10
July	MQ1	2,200	2,100	110	0.4
	MQ4	1,600	1,330	230	3
	MQ9	1,000	770	200	1
	MQ9(rep)	1,100	860	200	1
August	MQ1	1,400	1,200	210	4
	MQ4	3,300	3,000	280	0.6
	MQ9	1,200	1,000	200	0.1
September	MQ1	2,300	2,100	190	17.2
	MQ4	2,600	2,400	190	0.2
	MQ9	1,600	1,400	240	9.6

Table 1-19 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2012**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	2,300	1,980	330	5
	LL4	3,200	2,570	590	6
	LL9	1,000	800	190	6
May	LL1	3,000	2,470	470	15
	LL4	2,200	1,640	600	7
	LL9	2,300	2,050	280	7
June	LL1	1,400	1,080	310	3
	LL4	1,700	1,400	320	2
	LL9	980	810	170	2
	LL9 (rep)	1,200	1,020	140	1
July	LL1	1,600	1,390	170	3
	LL4	Sample lost in transit (broken bottle)			
	LL9	880	730	150	2
August	LL1	970	740	210	19
	LL1 (rep)	940	760	170	14
	LL4	1,300	990	250	35
	LL9	380	250	130	0.5
September	LL1	Sample unpreserved – no analysis done			
	LL4	2,800	2,350	480	1
	LL9	Sample unpreserved – no analysis done			
April	MQ1	2,200	2,010	200	3
	MQ4	1,700	1,440	220	3
	MQ9	1,600	1,420	180	5
May	MQ1	1,100	990	140	1
	MQ4	830	680	140	0
	MQ9	1,200	1,000	150	0.2
June	MQ1	2,100	1,920	170	0.4
	MQ4	890	740	150	0.3
	MQ9	1,100	910	200	0.4
	MQ9 (rep)	1,100	920	200	0.5
July	MQ1	1,300	1,210	100	0.4
	MQ4	1,100	1,010	90	10
	MQ9	740	640	100	1
August	MQ1	1,030	860	180	0.8
	MQ1 (rep)	920	720	200	0.2
	MQ4	810	660	140	10
	MQ9	430	340	90	1.6
September	MQ1	900	730	170	0.5
	MQ4	760	650	115	2
	MQ9	580	430	160	0.5
June	NNL1	1,600	1,240	320	0.5
	NNL4	1,000	670	370	0.2
	NNL9	840	700	140	1
	NNL9 (rep)	880	730	160	0.8

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-19 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2012**

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
July	NNL1	1,300	1,000	260	1.2
	NNL4	1,700	1,390	310	1
	NNL9	820	540	280	0.2
August	NNL1	810	660	150	1.6
	NNL1 (rep)	790	590	200	1
	NNL4	1,800	1,350	440	0.8
	NNL9	730	530	195	0.04
September	NNL1	1,530	1,170	360	1.2
	NNL4	1,260	970	290	2
	NNL9	1,740	1530	220	0.2

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-20 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2013**

Sampling Site	Date	Depth	< 5mm (1,000X)	< 5 µm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
Long Lake	April	0.5 m	2,300	1,750	530	10
		1 m	3,000	2,470	570	15
	August	0.5 m	1,300	880	455	2
		1.0 m	1,700	1,170	470	15
	October	0.5 m	1,500	1,150	340	12
		1.0 m	1,900	1,440	400	14
Middle Quinsam Lake	April	0.5 m	1,350	1,080	270	2
		1.0 m	1,400	1,150	250	2
	August	0.5 m	1,300	1,045	235	7
		1.0 m	1,300	1,010	325	6
		1.0 m (rep)	1,200	990	230	9
	October	0.5 m	1,800	1,440	350	2
		1.0 m	1,900	1,570	290	2
		1.0 m (rep)	1,600	1,310	300	3
No Name Lake	April	0.5 m	1,300	900	370	45
		1.0 m	1,600	1,150	380	36
	August	0.5 m	1,200	880	440	5
		1.0 m	1,500	1,060	455	6
		1.0 m (rep)	1,700	1,315	470	8
	October	0.5 m	1,800	1,310	460	1
		1.0 m	1,600	1,060	540	1
Lower Quinsam Lake	April	0.5 m	1,800	1,420	406	2
		1 m	950	700	245	2
	August	0.5 m	960	810	150	2
		1.0 m	620	460	160	3
	October	0.5 m	1,300	1,040	200	12
		1.0 m	1,300	1,060	230	4

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-21 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2014**

Sampling Site	Date	Depth	< 5mm (1,000X)	< 5 µm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
Long Lake	April	1 m	3100	2665	330	86.6
	July	1 m	1700	1170	490	0.9
	October	1 m	1500	1200	290	18.6
Middle Quinsam Lake	April	1 m	1000	840	155	11.4
		1 m replicate	590	480	100	11.7
	July	1 m	3200	2950	240	0.5
	October	1 m	1700	1400	310	3.2
No Name Lake	April	1 m	1600	1260	290	83
	July	1 m	1300	970	310	2.5
		1 m replicate	1200	830	250	3.1
	October	1 m	1600	1400	200	1.7
		1 m replicate	1500	1200	230	2.2
Lower Quinsam Lake	April	1 m	1600	1400	225	7.6
	July	1 m	1200	1010	210	1.8
	October	1 m	2400	2000	350	66

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-22 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2015

Lake	Month	Depth (m)	< 5mm (1,000X)	< 5 µm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
Long	April	1	3700	3300	400	15
	July	1	1300	1030	260	6.6
	October	1	2100	1800	230	14.6
Middle Quinsam	April	1	1600	1300	300	2.4
	July	1	2900	1060	1850	2.8
	October	1	1150	920	230	0.3
No Name	April	1	1200	870	350	1.1
	July	1	880	610	260	6.6
	October	1	1350	1000	300	4.3
	October replicate	1	1200	920	280	4.5
Lower Quinsam	April	1	2200	1800	350	28
	April replicate	1	2300	1800	520	18
	July	1	3200	580	2630	3.3
	October	1	1500	1100	330	71

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-23 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2016**

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	< 5 µm (1,000 X)	5 to 25 µm (400 X)	> 25 µm (100 X)
Long	April	1,500	1,300	240	5.5
Middle Quinsam		1,100	882	240	2.8
No Name		1,100	864	240	1.8
No Name (replicate)		970	792	180	1.8
Lower Quinsam		1,500	1,200	260	5.4
Long	August	1,200	990	140	22
Middle Quinsam		930	810	116	1.5
No Name		1,800	1,200	500	42
No Name (replicate)		1,900	1,280	595	46
Lower Quinsam		2,400	1,850	578	1.4
Long	November	780	640	140	0.5
Middle Quinsam		610	520	90	3
No Name		650	600	50	0.4
Lower Quinsam		300	250	50	0

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-24 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2017**

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	< 5 µm (1,000 X)	5 to 25 µm (400 X)	> 25 µm (100 X)
Long	May	2,700	2,400	340	16.2
Middle Quinsam		1,900	1,500	370	15.4
No Name		1,300	1,000	320	7.9
Lower Quinsam		1,700	1,300	390	1.2
Long	Sept.	1,100	940	200	1.5
Middle Quinsam		980	760	220	0.9
No Name		1,400	860	480	29.8
No Name Replicate		1,500	1,000	450	28.1
Lower Quinsam		1,700	990	600	86.6
Long	Oct.	2,000	1,800	190	0.4
Middle Quinsam		860	770	80	7.5
No Name		1,600	1,370	260	1
No Name Replicate		1,800	1,400	390	4.2
Lower Quinsam		1,300	770	530	14.8

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-25 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2018**

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May	1,500	1,300	150	3.4
Long—duplicate		1,300	1,100	140	4.8
Middle Quinsam		1,000	920	110	0.4
No Name		1,800	1,500	250	0.1
Lower Quinsam		2,700	2,400	320	0.5
Long	August	1,200	1,100	110	1.7
Middle Quinsam		1,600	1,500	180	0.2
No Name		1,400	1,200	270	2
Lower Quinsam		2,300	680	1,600	13
Lower Quinsam—replicate		3,400	1,100	2,300	6.6
Long	November	9,200	2,500	210	6,500
Middle Quinsam		2,100	1,700	360	0.04
No Name		1,600	1,300	300	0.7
Lower Quinsam		1,800	1,500	230	96

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-26 **Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2019**

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	1-May	2,400	1,900	430	1
Long (duplicate)		2,100	1,700	420	1.7
Middle Quinsam	2-May	320	260	60	1.2
No Name	1-May	740	440	300	0.1
Lower Quinsam	2-May	600	500	99	1.2
Long	8-May	2,000	1,700	300	0.5
Middle Quinsam		1,000	920	80	0.4
No Name		2,700	2,100	570	0.03
Lower Quinsam		2,100	1,800	310	11.9
Long	30-Jul	2,600	2,300	220	1.3
Middle Quinsam		1,800	1,600	220	0.7
No Name		2,400	2,100	350	4.9
No Name (duplicate)		2,200	1,800	370	9
Lower Quinsam		1,900	1,500	320	1
Long	Oct. 24	2,400	1,900	450	0.7
Middle Quinsam		1,300	1,100	210	0.04

Attachment 1 Historical Abundance Data: Quinsam Lakes System, 1993–2020

Table 1-27 **Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2020**

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	12-May	3,400	2,800	330	275
Middle Quinsam		1,200	1,150	65	4.2
No Name ¹		4,100	1,600	2,500	0.4
Lower Quinsam	13-May	4,000	3,500	360	95
Long	5-Aug	2,600	2,400	160	13
Middle Quinsam		1,500	1,300	190	0.4
Middle Quinsam replicate		1,400	1,200	200	0.5
Long	7-Oct	3,200	3,000	200	2.6
Long replicate		3,000	2,800	200	1.6
Middle Quinsam		3,000	2,700	250	2.2
NOTE:					
^{1.} <i>Dinobryon</i> spp. counted at 400X rather than 100X due to high abundance					

ATTACHMENT 2

Species Composition Data: May, 2021

Prepared by FRASER ENVIRONMENTAL SERVICES						
Prepared for Quinsam Coal Corporation						
taxa and abundance of zooplankton samples						
level of id. : lowest/lowest						
Spring Zooplankton Sampling 2021						
Site Name		LLM	LLM	MQL	LQL	NNL
EMS ID #		E206619	E206619	E206618	E292118	E217018
FES Sample Number		210008	210009	210010	210011	210012
Sampling Date(s)		May. 4,2021-M	May. 4,2021-R	May. 4,2021-M	May. 4,2021-M	May. 4,2021-M
units = total organisms/sample						
	stage					
Sub-class : Copepoda						
Order : Cyclopoida						
<u>Acanthocyclops vernalis</u>	adult	25	9	3		
<u>Cryptocyclops bicolor</u>	adult		34	3		18
<u>Diacyclops thomasi</u>	adult	148	51	27	144	
<u>Microcyclops varicans</u>	adult	50	25			
UID	copepodid	101	25	19	189	54
Order : Calanoida						
Family : Diaptomidae						
<u>Hesperodiaptomus novemdecimus</u>	adult	3	10	19		87
<u>Skistodiaptomus oregonensis</u>	adult	25	13	2	65	44
UID	copepodid	38	38	15	30	116
UID Calanoida / Cyclopoida	nauplii	1,627	846	566	1,347	314
Order : Cladocera						
<u>Bosmina longirostris</u>	adult	40	28	30	99	13
<u>Bosmina longirostris</u>	juvenile				43	
<u>Daphnia longiremis</u>	adult	89	64	6	2	36
<u>Daphnia rosea</u>	adult	101	76	337	45	126
<u>Daphnia sp.</u>	juvenile	18	23	66	15	13
<u>Diaphanosoma brachyurum</u>	adult	5	3			
<u>Holopedium gibberum</u>	adult			11		262
<u>Holopedium gibberum</u>	juvenile					28
<u>Polyphemus pediculus</u>	adult			2		
<u>Sida crystallina</u>	adult	3	5			
Phylum : Rotifera						
<u>Asplanchna sp.</u>		81	30	2		
<u>Conochilus sp.</u>	solitary					112
<u>Kellicottia longispina</u>		106	79	19	4	77
<u>Keratella cochlearis</u>		3,976	1,979	135	88	5
<u>Keratella quadrata</u>		56	41	6	2	3
<u>Polyarthra sp.</u>		187	206	4	46	28
UID		3			6	
TOTAL		6,682	3,585	1,272	2,125	1,336
UID = unidentified due to lack of size and/or missing morphological characters.						

ATTACHMENT 2

Species Composition Data: July, 2021

Prepared by FRASER ENVIRONMENTAL SERVICES				
Prepared for Quinsam Coal Corporation				
taxa and abundance of zooplankton samples				
level of id. : lowest/lowest				
Summer Zooplankton Sampling 2021				
Site Name		LLM	MQL	LLM
EMS ID #		E206619	E206618	E206619
FES Sample Number		210015	210016	210017
Sampling Date(s)		July 12,2021-M	July 12,2021-M	July 12,2021-R
units = total organisms/sample				
	stage			
Sub-class : Copepoda				
Order : Cyclopoida				
<u>Acanthocyclops vernalis</u>	adult	3		
<u>Cryptocyclops bicolor</u>	adult	3	50	
<u>Diacyclops thomasi</u>	adult		20	
<u>Ectocyclops phaleratus</u>	adult			6
<u>Microcyclops varicans</u>	adult	7		
UID	copepodid	31	119	58
Order : Calanoida				
Family : Diaptomidae				
<u>Hesperodiaptomus novemdecimus</u>	adult		23	
<u>Skistodiaptomus oregonensis</u>	adult	138	213	106
UID	copepodid	99	69	52
UID Calanoida / Cyclopoida	nauplii	240	211	304
Order : Cladocera				
<u>Bosmina longirostris</u>	adult	44	74	27
<u>Bosmina longirostris</u>	juvenile	6		3
<u>Ceriodaphnia reticulatus</u>	adult	20	3	18
<u>Daphnia longiremis</u>	adult	36		30
<u>Daphnia rosea</u>	adult	923	694	635
<u>Daphnia sp.</u>	adult	42	51	55
<u>Daphnia sp.</u>	juvenile	131	102	61
<u>Diaphanosoma birgei</u>	adult		7	
<u>Diaphanosoma brachyurum</u>	adult	42	26	15
<u>Leptodora kindtii</u>	adult	2	2	3
<u>Polyphemus pediculus</u>	adult	26	2	24
Phylum : Rotifera				
<u>Asplanchna sp.</u>		68		49
<u>Conochilus sp.</u>	colonies		5	
<u>Kellicottia longispina</u>		128	15	125
<u>Keratella cochlearis</u>		13	14	15
<u>Keratella quadrata</u>		3	2	
<u>Polyarthra sp.</u>		3	5	6
UID		9		3
Benthic				
Group : Hydracarina			7	
TOTAL		2,017	1,714	1,595
UID = unidentified due to lack of size and/or missing morphological characters.				

ATTACHMENT 2

Species Composition Data: October, 2021

Prepared by FRASER ENVIRONMENTAL SERVICES				
Prepared for Quinsam Coal Corporation				
taxa and abundance of zooplankton samples				
level of id. : lowest/lowest				
Fall Zooplankton Sampling 2021				
Site Name		LLM	MQL	MQL
EMS ID #		E206619	E206618	E206618
FES Sample Number		210022	210023	210024
Sampling Date(s)		Oct.6,2021-M	Oct.6,2021-M	Oct.6,2021-R
units = total organisms/sample				
	stage			
Sub-class : Copepoda				
Order : Cyclopoida				
<u>Cryptocyclops bicolor</u>	adult	16	4	
<u>Diacyclops thomasi</u>	adult		4	
<u>Ectocyclops phaleratus</u>	adult	5		
UID	copepodid	7	17	3
Order : Calanoida				
Family : Diaptomidae				
<u>Hesperodiaptomus novemdecimus</u>	adult			3
<u>Skistodiaptomus oregonensis</u>	adult	32	119	136
UID	copepodid		47	22
UID Calanoida / Cyclopoida	nauplii	67	17	34
Order : Cladocera				
<u>Bosmina longirostris</u>	adult	32	28	65
<u>Bosmina longirostris</u>	juvenile		3	6
<u>Ceriodaphnia reticulata</u>	adult	11		
<u>Daphnia longiremis</u>	adult	28	11	
<u>Daphnia rosea</u>	adult	190	240	386
<u>Daphnia sp.</u>	adult	7		6
<u>Daphnia sp.</u>	juvenile	7	17	9
<u>Daphnia sp.</u>	ephippium	4		
<u>Diaphanosoma brachyurum</u>	adult	91	25	19
<u>Leptodora kindtii</u>	adult			3
Phylum : Rotifera				
<u>Conochilus sp.</u>	cells		11	3
<u>Kellicottia longispina</u>		123	17	6
<u>Keratella cochlearis</u>				9
<u>Polyarthra sp.</u>			160	53
UID			6	
Benthic				
Group : Hydracarina				3
TOTAL		620	726	766
UID = unidentified due to lack of size and/or missing morphological characters.				
Note : The solitary Conochilus (individual counts) versus colony counts distort the total counts per sample.				
The number of individual Conochilus in a colony can average anywhere between 25-90 individuals.				