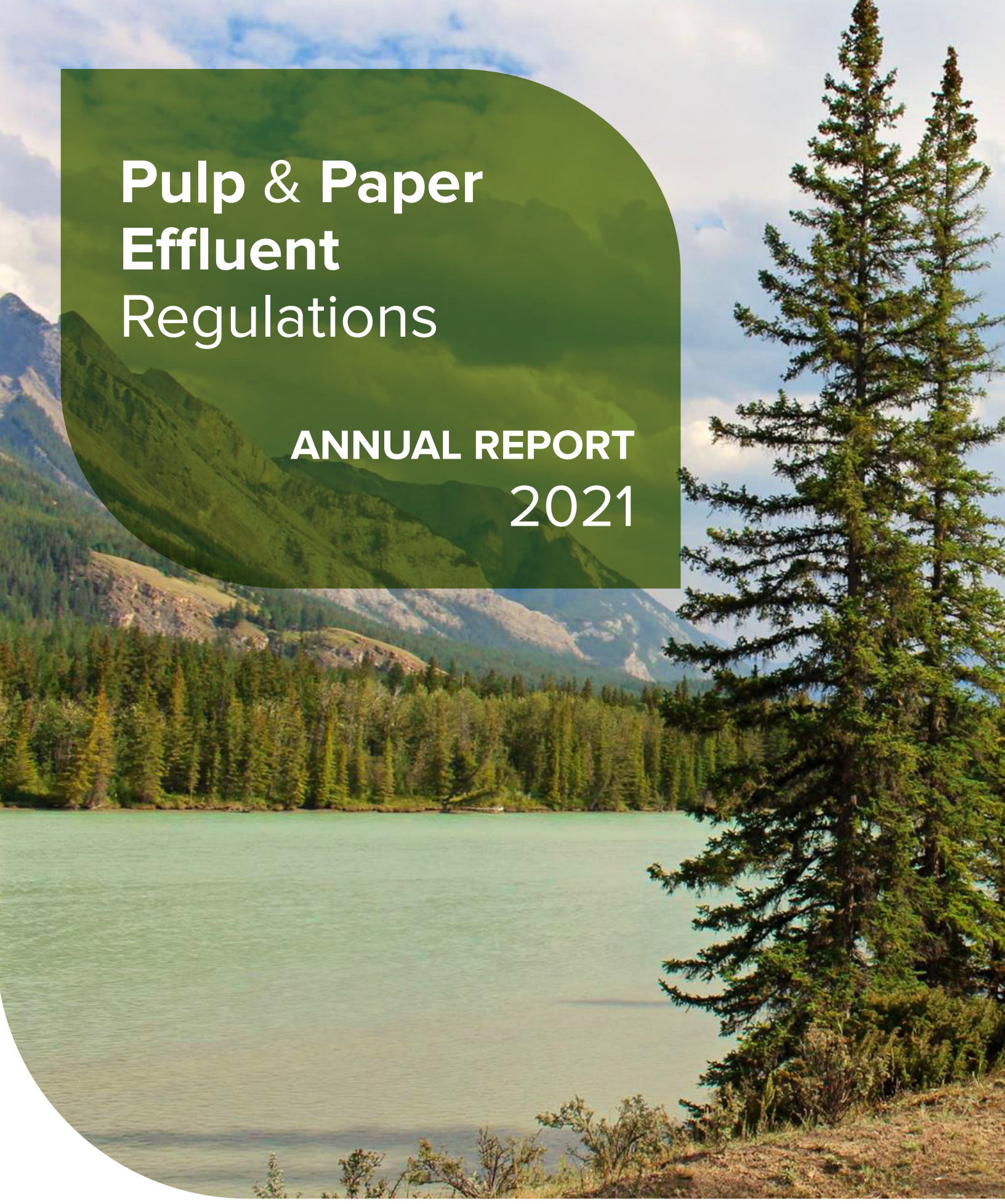

Pulp & Paper Effluent Regulations

ANNUAL REPORT 2021

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Aussi disponible en français

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REVIEW NOTICE

The information used in this report was submitted to Environment and Climate Change Canada (ECCC) by regulated pulp and paper mills and off-site treatment facilities as required under section 7 of the *Pulp and Paper Effluent Regulations* (PPER) pursuant to the Fisheries Act. Environment and Climate Change Canada compiled this report to inform the regulated community, other stakeholders and the interested public on the PPER, for informational purposes only. For all purposes of interpreting and applying the law, users should consult the *Pulp and Paper Effluent Regulations*, as registered by the Clerk of the Privy Council and published in Part II of the Canada Gazette.

EXECUTIVE SUMMARY

This report summarizes compliance and effluent discharge amounts of Canadian pulp and paper mills with respect to the selected standards prescribed by the *Pulp and Paper Effluent Regulations* (PPER), which came into force on May 7, 1992.

The data used in this report were provided to Environment and Climate Change Canada under section 9, 28, 29, and 30 of the Regulations, which requires mills to submit monthly reports to Environment and Climate Change Canada as well as environmental effects monitoring (EEM) reports on a designated cycle. The format for the monthly effluent reports is specified in Schedule II of the Regulations. The monthly effluent reports include:

- the biochemical oxygen demand (BOD) of BOD matter in effluent;
- the quantity of suspended solids in effluent;
- effluent volume; and
- summary results of rainbow trout acute lethality tests and *Daphnia magna* monitoring tests.

In 2021, 74 pulp and paper mills operating in Canada were subject to the Regulations. The self-reported data showed a high level of compliance, with 99% of results below the limits for suspended solids (SS) and biological oxygen demand (BOD), 97% of tests not acutely lethal to rainbow trout, and 98.5% of tests showing no effect on *Daphnia magna.*

The annual effluent loading from Canadian pulp and paper mills (SS released per tonne of production and kilograms of BOD released per tonne of production) remained stable at the national level, with a total of 2.76 kg/tonne of production of SS and 1.29 kg/tonne of production of BOD released to the environment in 2021.

Canadian pulp and paper mills subject to the PPER are required to conduct comprehensive environmental effects monitoring (EEM) studies. The EEM requirements consist of sublethal toxicity testing of mill final effluent and biological monitoring studies conducted in the receiving environment to assess potential impacts of effluent. Mill final effluents show sublethal toxicity impacts of growth and reproduction inhibition in laboratory test species in more than half of all tests conducted. The data from biological monitoring studies, submitted up until 2019 show that mill final effluents from 77% of the mills have impacts on receiving environments.

INTRODUCTION

The *Pulp and Paper Effluent Regulations* (PPER) were first published, under the *Fisheries Act* in 1971 to control discharges of deleterious substances and reduce the effects on fish and fish habitat that had been observed at pulp and paper mills across Canada at that time. By the late 1980s, Environment and Climate Change Canada had determined that the 1971 Regulations had not yielded all of the desired effluent quality improvements. The Government amended the PPER in 1992 to introduce enforceable effluent quality standards for all mills; a requirement for effluents to be non-acutely lethal to rainbow trout; and a requirement to conduct comprehensive environmental effects monitoring (EEM) studies to assess potential impacts of mill effluent on receiving environments.

The PPER set limits on the amounts of biochemical oxygen demand (BOD) matter and suspended solids (SS) that may be deposited by pulp and paper mills, and prohibit deposits of effluents that are acutely lethal to rainbow trout. The PPER also set out monitoring and reporting requirements. The Regulations are administered by Environment and Climate Change Canada and apply to all pulp and paper mills in Canada. The full text of the Regulations outlining all the requirements is available online at the following link.

This report summarizes compliance, effluent quality data and environmental effects monitoring results up to and including 2021. Supplementary information on individual mills is provided in the appendices.

OVERVIEW OF DIRECT DEPOSIT MILLS SUBJECT TO THE PPER IN 2021

In 2021, 74 pulp and paper mills depositing effluent directly into water frequented by fish in Canada were subject to the Regulations. These mills have a total of 116 outfall structures, which are structures through which effluent is conveyed from a mill to a location where it is deposited in water frequented by fish, or in any place from which it may enter such water, or to a wastewater treatment system. Mills are located in all provinces except for Prince Edward Island and Saskatchewan. No mills are located in the territories. A map illustrating each mill's location is presented in Figure 1. A detailed list of mills is in Appendix A.

***Figure 1**: Distribution of Canadian Mills in Operation (2021)*

OVERVIEW OF ANNUAL COMPLIANCE AND DISCHARGE AMOUNTS OVER TIME

Table 1 shows compliance of self-reported data on suspended solids, BOD tests, acute lethality tests on rainbow trout, and effect on *Daphnia magna* tests. In addition, Table 1 shows the total suspended solids and BOD discharged annually under the PPER from 2006 to 2021.

TABLE 1: *PPER COMPLIANCE AND TOTAL ANNUAL DISCHARGE AMOUNTS OVER TIME*

YEAR	Total Number Of Mills Subject To PPER[1]	Total Effluent Flow (million m^3)	Total Biochemical Oxygen Demand (kt)	Total Suspended Solids (kt)	Total BOD Tests Passed (%)	Total SS Tests Passed (%)	Total Acute Lethality Percent of Tests Passed (%)	Total *Daphnia magna* Percent of Tests Passed (%)
2006	113	1880	38.2	80.2	99.9	99.7	98.7	98.6
2007	105	1831	37.1	81.0	99.9	99.8	97.5	98.2
2008	104	1705	35.5	71.8	99.9	99.9	97.4	98.7
2009	100	1467	27.9	60.4	99.9	99.9	97.2	98.7
2010	93	1505	30.6	64.5	99.7	99.8	97.6	98.1
2011	88	1506	32.6	72.2	99.8	99.7	95.9	98.2
2012	85	1459	29.7	62.2	99.7	99.8	98.3	98.6
2013	81	1482	29.0	62.0	99.9	99.8	96.2	98.3
2014	81	1428	28.2	62.4	99.9	99.8	97.5	97.9
2015	77	1367	26.4	53.8	99.9	99.9	97.6	98.5
2016	77	1366	24.5	49.8	99.9	99.9	97.3	97.9
2017	77	1352	24.8	51.2	99.9	99.9	97.5	98.7
2018	77	1353	26.2	53.8	99.9	99.9	98.3	98.5
2019	77	1310	24.8	52.4	99.9	99.9	97.8	98.0
2020	74	1232	21.9	45.6	99.9	99.9	97.4	98.7
2021	74	1263	22.1	47.0	99.8	99.9	97.4	98.5

[1] This refers to mills depositing effluent directly into water frequented by fish

SECTION 1: COMPLIANCE OF DIRECT DEPOSIT MILLS SUBJECT TO THE PPER IN 2021

Analysis of the self-reported effluent data generated during 2021 by Canadian pulp and paper mills concluded that mills continued to have high rates of compliance with the effluent quality limits prescribed in the PPER. In 2021, compliance rates calculated from self-reported data were over 99% for SS and BOD, and 97.4% for the requirement that effluent not be acutely lethal to rainbow trout. Although not a regulatory compliance parameter, the effect on *Daphnia magna* test is reported. Should a *Daphnia magna* test be failed, a mill is then required to perform an additional acute lethality test. The percentage of passed tests for effect on *Daphnia magna* was 98.5%. Figure 2 shows compliance for effluent parameters in 2021, and Figure 3 shows compliance for effluent parameters from 2006 - 2021.

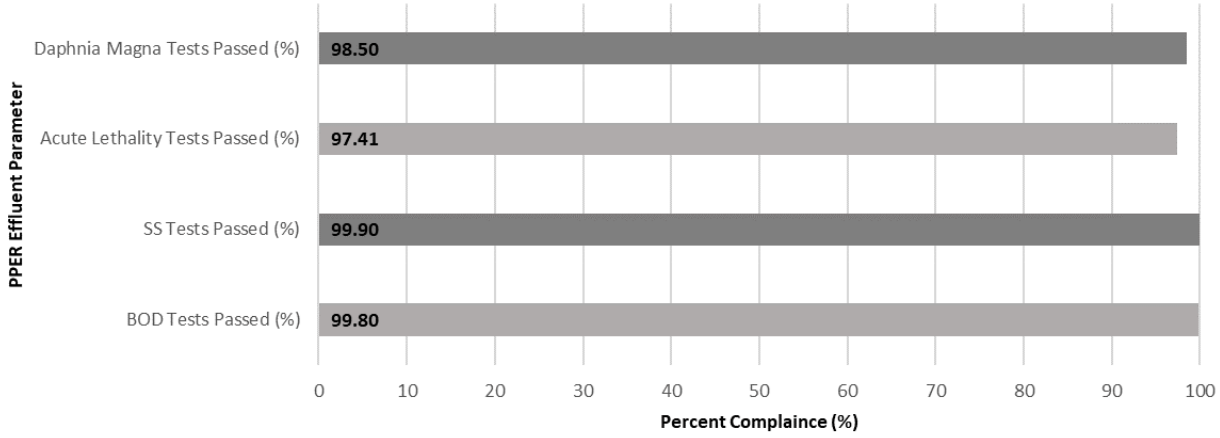

Figure 2: *PPER Effluent Parameter Compliance (2021)*

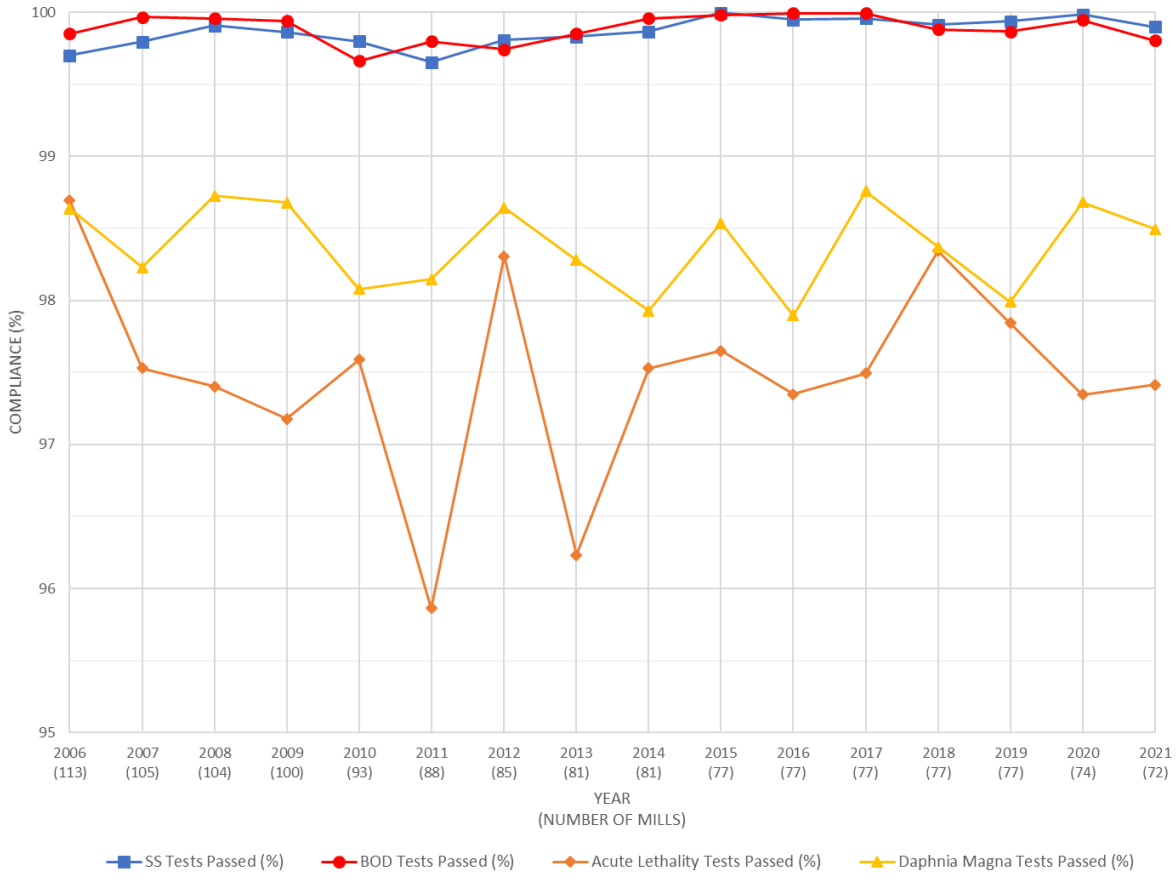

Figure 3: *PPER Effluent Parameter Compliance over Time (2006 - 2021)*

SECTION 2: REGULATORY DATA SUMMARY OF DIRECT DEPOSIT MILLS SUBJECT TO THE PPER IN 2021

Analysis of the self-reported effluent data generated during 2021 by Canadian pulp and paper mills showed mills deposited 1,263 million cubic metres of effluent, 47.0 kilotonnes of suspended solids and 22.1 kilotonnes of BOD matter. Figure 4 illustrates total releases from all Canadian mills in 2021. Figures 5 and 6 below demonstrate the total annual release of BOD and SS by Canadian pulp and paper mill effluent at the national level from 2006 to 2021.

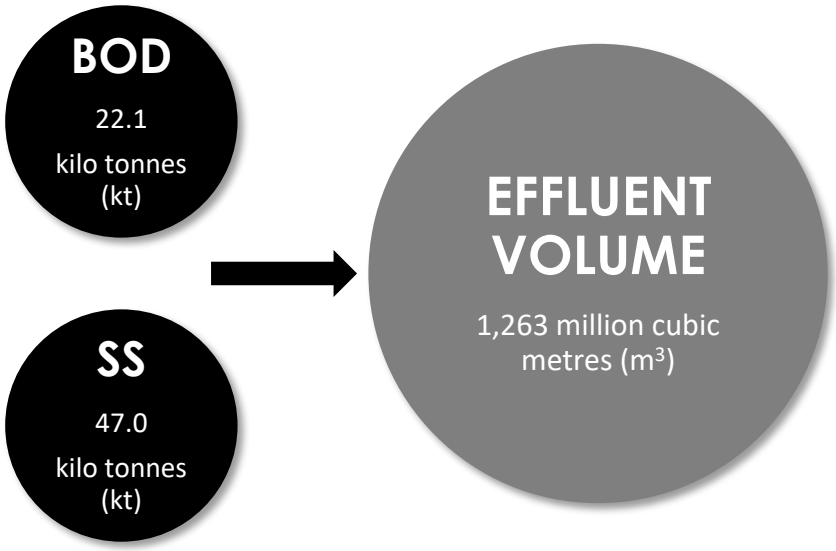

***Figure 4**: Total Deleterious Substances and Effluent Deposited by Canadian Mills Subject to the PPER in 2021*

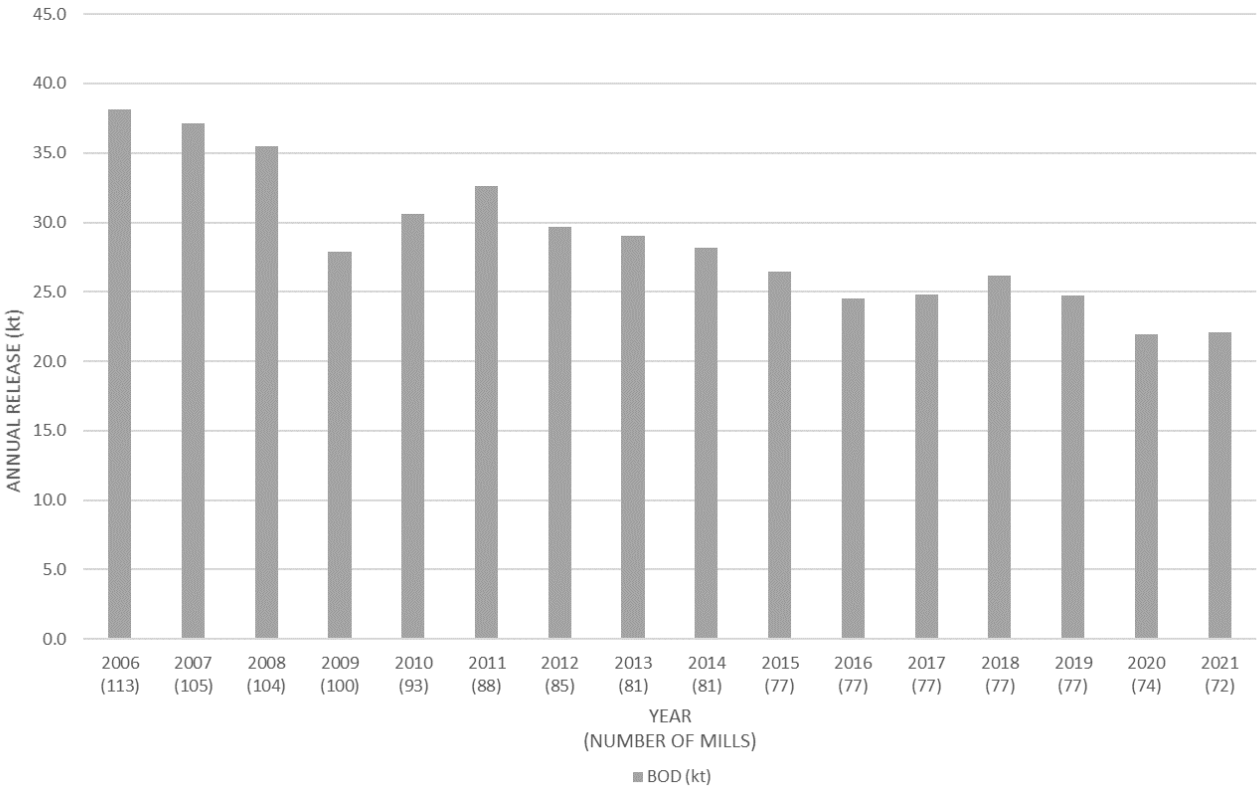

***Figure 5**: Annual Release of BOD by Canadian Pulp and Paper Mill Effluent over Time (2006 – 2021)*

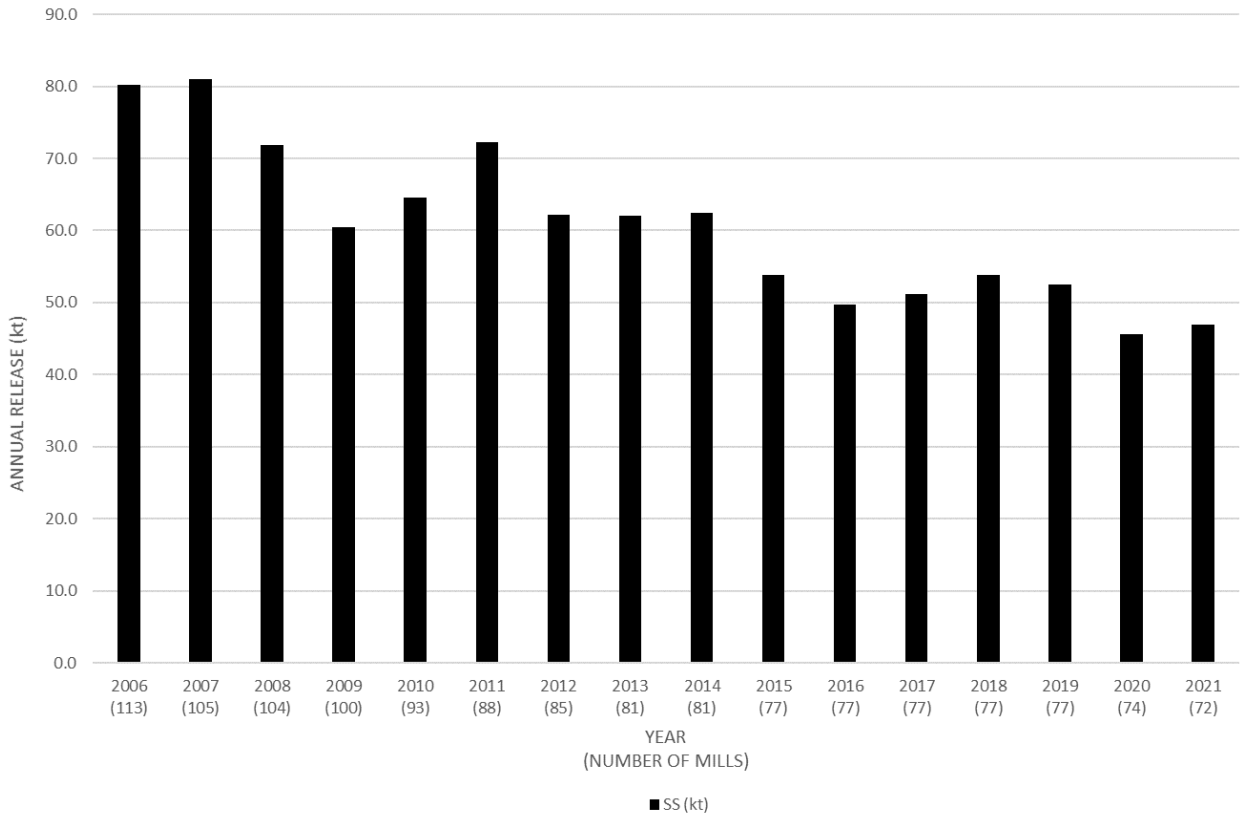

Figure 6: *Annual Release of SS by Canadian Pulp and Paper Mill Effluent over Time (2006 – 2021)*

Figures 7 and 8 demonstrates the annual effluent loading, kilograms of BOD and SS released per tonne of production, in Canadian pulp and paper mill effluent at the national level from 2006 to 2021.

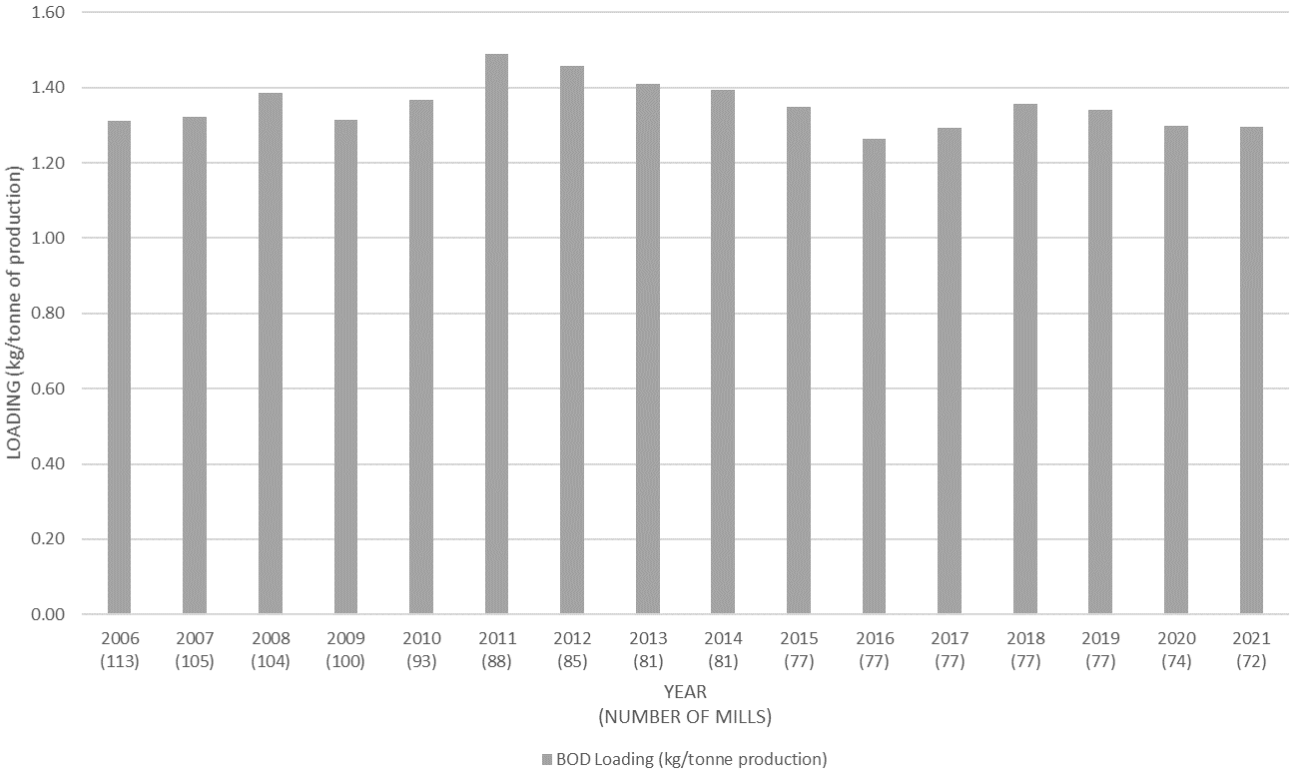

Figure 7: *Annual Loading of BOD by Canadian Pulp and Paper Mill Effluent over Time (2006 – 2021)*

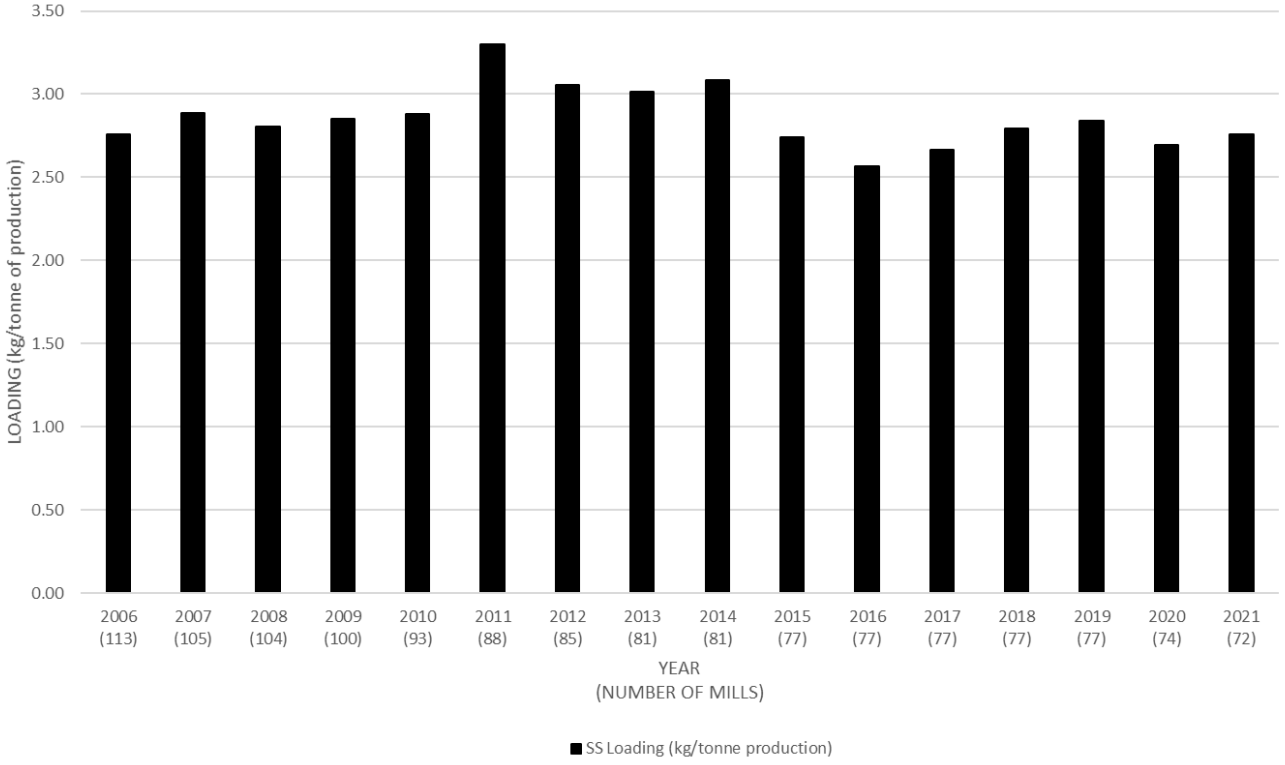

Figure 8: *Annual Loading of SS by Canadian Pulp and Paper Mill Effluent over Time (2006 – 2021)*

Figure 9 demonstrates both the effluent volume released on an annual basis (effluent efficiency) by Canadian pulp and paper mills, compared to the total effluent volume released per tonne of production of all Canadian pulp and paper mills from 2006 to 2021. Effluent volume has decreased since 2006, and effluent volume per tonne of production has increased.

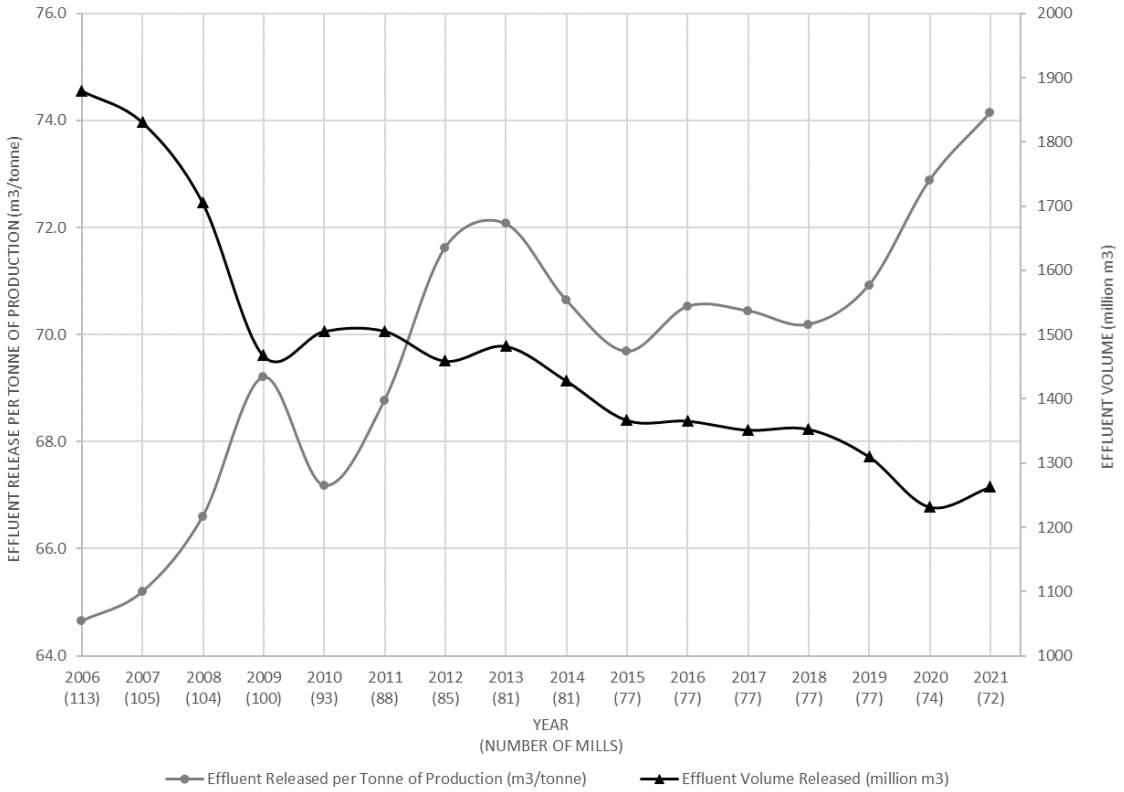

Figure 9*: Total Effluent Volume and Total Effluent Released Per Tonne of Production by Canadian Pulp and Paper Mills over Time (2006 – 2021)*

Figure 10 represents the total number of instances where effluent was found to be acutely lethal to rainbow trout, and the total number of times effluent had an effect on *Daphnia magna* by Canadian pulp and paper mill effluent from 2006 to 2021.

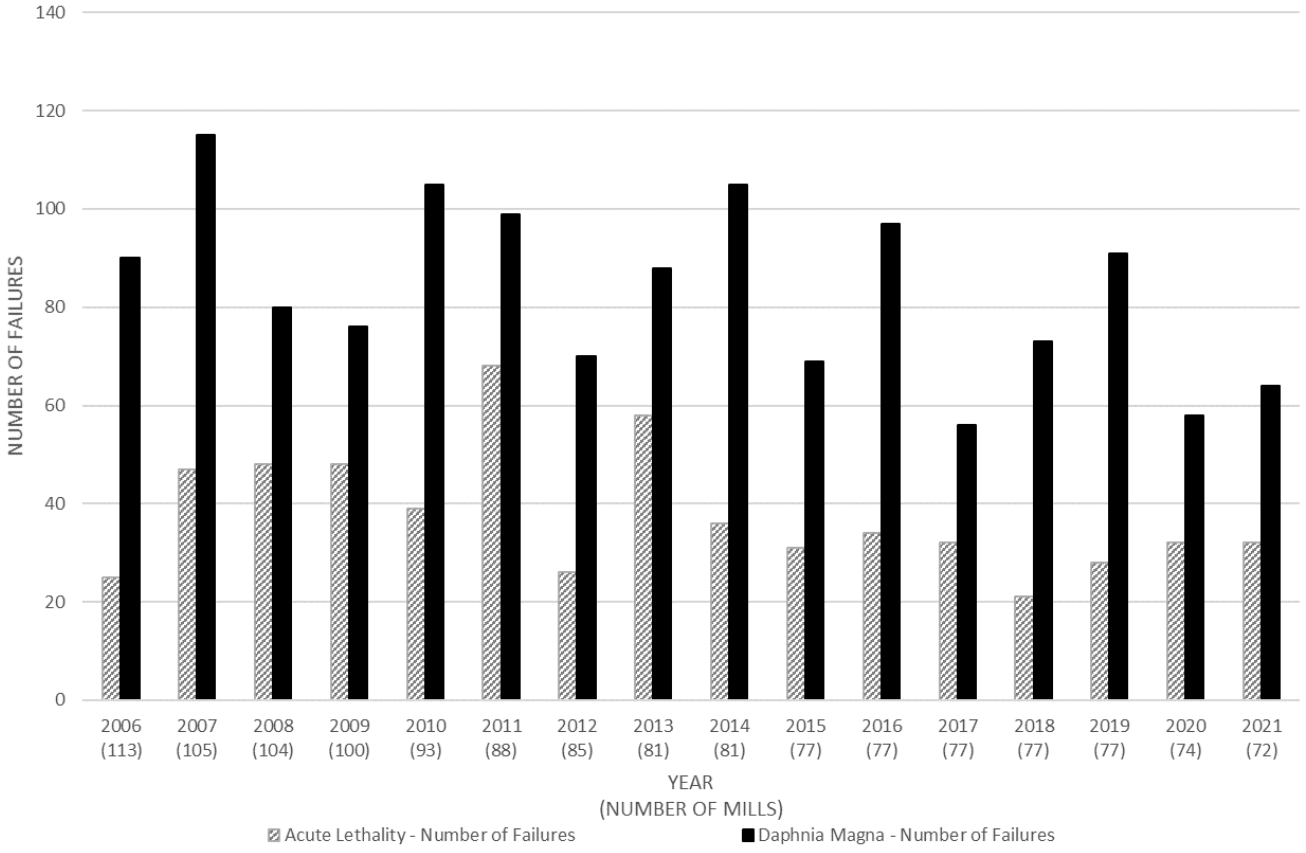

***Figure 10**: Total Number of Failures of Acute Lethality (Rainbow Trout) and Daphnia Magna Testing By Canadian Pulp and Paper Mill Effluent over Time (2006 – 2021)*

SECTION 3: ENVIRONMENTAL EFFECTS MONITORING RESULTS

Environmental effects monitoring (EEM) is a science-based, performance measurement tool used to collect information for assessing the effectiveness of effluent regulations in achieving objectives of protecting water quality that sustains fish, fish habitat, and the use of fisheries resources. The EEM requirements in the PPER consists of sublethal toxicity testing of mill final effluent and biological monitoring studies conducted to assess potential impacts of effluent on receiving environments and to determine the cause of and identify solutions for any observed impacts. Information gained through sublethal toxicity testing supports the interpretation of biological monitoring study results. Biological monitoring studies are presently conducted every three years over a period of three years, and there have been eight study periods since the EEM requirements came into force in 1992. Data obtained through PPER EEM requirements from all eight study periods are summarized below and more detailed information for each mill is listed in Appendix C.

TABLE 2: *BIOLOGICAL STUDY MONITORING PERIODS FOR EEM*

FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH	SEVENTH	EIGHTH
1992 - 1996	1996 - 2000	2000 - 2004	2004 - 2007	2007 - 2010	2010 - 2013	2013 - 2016	2016 - 2019

SUBLETHAL TOXICITY OF FINAL EFFLUENT

Mills are required to conduct sublethal toxicity (SLT) testing on final effluent. These tests assess the non-lethal (sublethal) impacts of effluent on growth and reproduction. The measurement used to assess sublethal impacts is the effluent concentration that causes a 25% reduction in growth or reproduction in test organisms, known as the *inhibiting concentration* (IC_{25}). If a 100% concentration of effluent causes less than a 25% inhibition, the effluent is reported as showing no sublethal toxicity for that test. Starting in 1992, sublethal toxicity testing has been conducted twice a year by all Canadian mills in production or once a year if the mill released effluent on fewer than 120 days in that calendar year. Figure 11 depicts the percentage of sublethal toxicity tests conducted during each of the biological monitoring study periods where sublethal toxicity was reported.

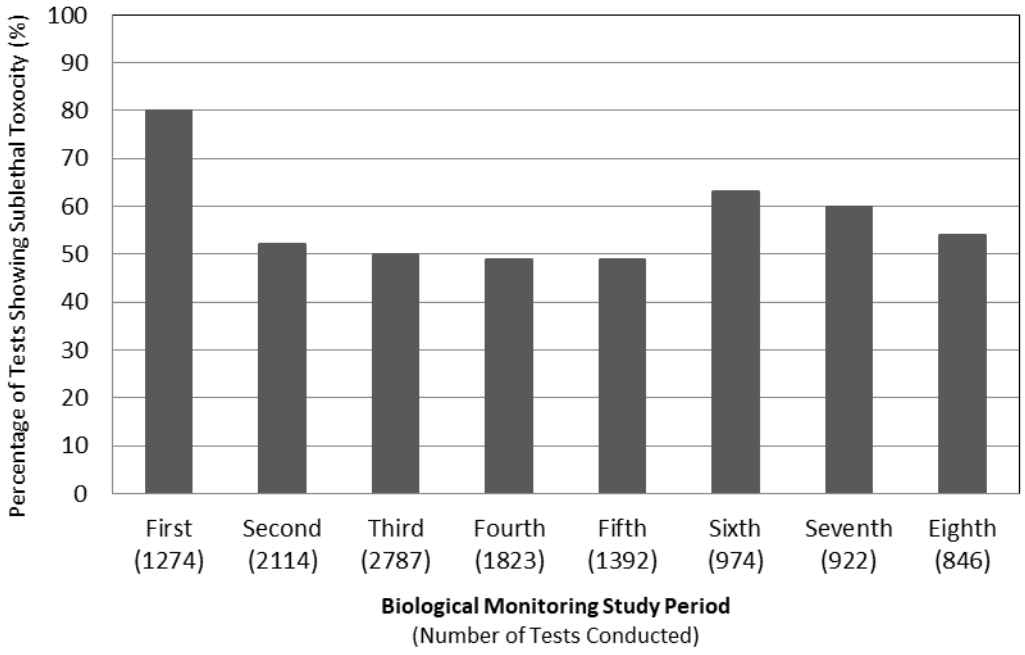

Figure 11: *Percentage of Tests Showing Sublethal Toxicity during Each Biological Monitoring Study Period (Number of Tests Conducted)*[2]

[2]Chart represents all SLT testing conducted on algae, invertebrates and fish.

BIOLOGICAL MONITORING STUDIES

Biological monitoring studies are conducted to assess and investigate[3] effects in three components: fish health, fish habitat and human usability of fisheries resources. To assess effects of mill effluent on fish health and/or habitat, biological monitoring studies are conducted to compare statistical differences between data collected in an area exposed to mill effluent to data from a similar area not exposed to mill effluent.[4] For human usability of fisheries resources, fish tissue data from the exposure area are assessed against an established threshold for chlorinated dioxins and furans. If mill effluent has an effect on any one or more of the 3 components, the biological monitoring studies determine the cause of the effect and then identify solutions to eliminate the effect.

Data from all eight biological monitoring study periods have been reviewed. Figure 12 depicts the percentage of these mills for which effluent is designated as showing effects or showing an absence of effects based on all studies conducted as of 2019. A percentage of mills are not required to conduct biological monitoring studies because the mill's effluent dilutes to less than 1% at a distance of 100 meters from where the effluent is released into the environment.

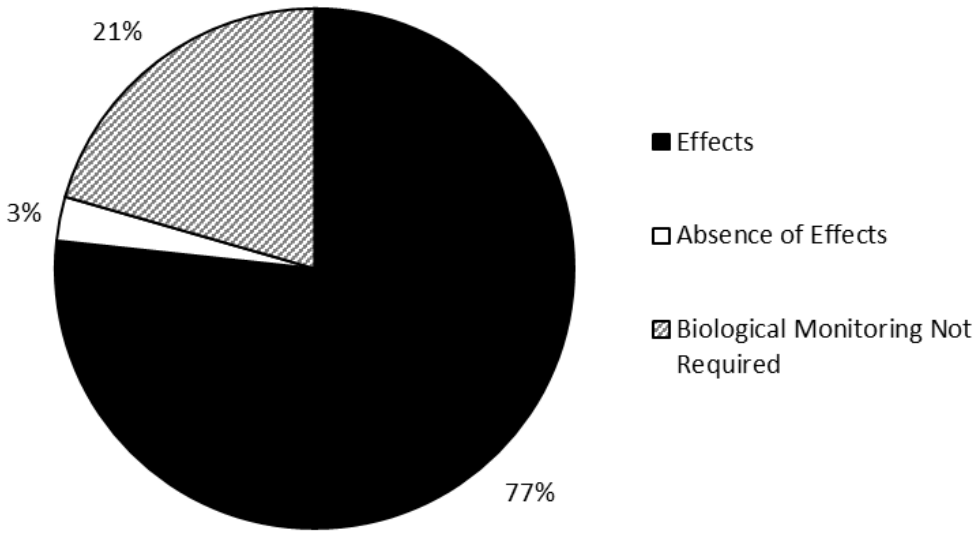

***Figure 12**: Percent Effects Designation for Canadian Mills in Operation (As of 2019)*[5]

The prevalent effects on fish are due to more nutrients in the receiving environment, sometimes combined with an effect on reproduction (reduced fish gonad size). The prevalent effects on fish habitat, measured by assessing benthic invertebrate communities, are associated with eutrophication from nutrient enrichment.

[3] For a summary of EEM studies investigating the cause of and solutions for observed effects, see the Sixth National Assessment of Environmental Effects Monitoring Data from Pulp and Paper Mills Subject to the *Pulp and Paper Effluent Regulations*

[4] For more detail on biological monitoring effects, please consult the *Pulp and Paper Effluent Regulations*

[5] Includes effects on fish health and fish habitat components based on the most recent one or two studies conducted at each mill. One mill has an effect on human usability of fisheries resources.

APPENDIX A: OVERVIEW OF CANADIAN DIRECT DEPOSIT MILLS SUBJECT TO THE PPER (2021)

ID	COMPANY: MILL NAME	LOCATION	PROVINCE	NUMBER OF OUTFALLS	OUTFALL NAME	RECEIVING ENVIRONMENT[6]
QC01	Sappi: Matane, QC	400 Rue du Port, Matane, G4W 3P6	Quebec	1	Final Effluent - Biological Treatment	Saint-Lawrence River
QC02	Papiers White Birch - F.F. Soucy: Riviere-du-Loup, QC	191 Delage Street, Rivière-du-Loup, G5R 6E2	Quebec	1	Final Effluent - 1 - EF	Rivière Du Loup
QC03	Cascades: Cabano, QC	520 Rue Commerciale N, Témiscouata-sur-le-Lac, G0L 1E0	Quebec	1	Final Effluent - Mix of 2 Effluents: biologically treated and untreated process water	Cabano River
QC04	Resolute Forest Products: Alma, QC	1100 Melancon West Street, Alma, G8B 5R7	Quebec	1	Final Effluent	Petite Décharge River
QC05	Resolute Forest Products: Kénogami, QC	3750 Champlain Street, Jonquière, G7S 5J7	Quebec	1	Final Effluent - 1	Saguenay River
QC06	Fibrek : Saint-Félicien, QC	4000 Rte. St. Eusebe, St. Félicien, G8K 2R6	Quebec	7	Final Effluent - Ashuapmushaun River (site 61) with combination	Mistassini & Ashuapmushuan Rivers
					Final Effluent - Ashuapmushaun River (site 61) without combination	
					Final Effluent - Mistassini River (site 01) with combination	
					Final Effluent - Mistassini River (site 01) without combination	
					Final Effluent Cooling Water - Ashuapmushaun River (site 61)	
					Non-treated Effluent (site 21)	
					Treated Effluent - Biological Treatment (site 11)	
QC07	Resolute Forest Products: Dolbeau, QC	1, 4e Avenue, Dolbeau, G8L 2R4	Quebec	1	Final Effluent	Mistassini River
QC08	BP Canada: Pont Rouge, QC	420 Rue Dupont, Pont Rouge, G3H 1S2	Quebec	1	Final Effluent	Jacques-Cartier River
QC09	MPI Moulin: Portneuf, QC	200 Rue du Moulin, Portneuf, G0A 2Y0	Quebec	1	Final Effluent	Portneuf River

[6] Environment in which the effluent is deposited post treatment

ID	COMPANY: MILL NAME	LOCATION	PROVINCE	NUMBER OF OUTFALLS	OUTFALL NAME	RECEIVING ENVIRONMENT[6]
QC10	Papiers White Birch: Stadacona, QC	10 Boulevard des Capucins, Stadacona, G1J 3R4	Quebec	1	Final Effluent	Saint-Lawrence River
QC11	Resolute Forest Products: Clermont, QC	100 Rue Donohue, Clermont, G4A 1A7	Quebec	1	Final Effluent	Malbaie River
QC12	Cascades: Kingsey Falls, QC	467 Boulevard Marie-Victorin, Kingsey Falls, J0A 1B0	Quebec	1	Final Effluent	Nicolet River
QC14	Westrock: La Tuque, QC	1000 Chemin De L'Usine, La Tuque, G9X 3P8	Quebec	1	Final Effluent - 1 EF	St-Maurice River
QC15	Kruger - Wayagamack: Trois-Rivières, QC	Chemin de l'ile-de-la-Potherie, Trois-Rivières, G9A 5E9	Quebec	3	Final Effluent - Outfall #1 Final Effluent - Outfall #5 Final Effluent - Biological Treatment	Saint-Lawrence & St-Maurice River
QC16	Kruger: Trois-Rivières, QC	3735 Blvd Gene H. Kruger, Trois-Rivières, G9A 6B1	Quebec	1	Final Effluent	Saint-Lawrence River
QC17	Domtar: Windsor, QC	609 12e Rang, Windsor, J1S 2L9	Quebec	1	Final Effluent	Saint-François River
QC18	Kruger: Brompton, QC	220 route de Windsor, Sherbrooke, J1C 0E6	Quebec	1	Final Effluent	Saint-François River
QC19	Kruger: Sherbrooke, QC	2888 Rue du College, Sherbrooke, J1M 1Z4	Quebec	1	Final Effluent	Massawippi River
QC20	Resolute Forest Products: Gatineau, QC	79 Rue Main, Gatineau, J8P 4C8	Quebec	1	Final Effluent	Ottawa River
QC21	Papiers White Birch - Papiers Masson: Gatineau, QC	2 Chemin de Montréal O, Gatineau, J8M 1A4	Quebec	1	Final Effluent	Ottawa River
QC22	Fortress Specialty Cellulose: Thurso, QC	451 Rue Victoria, Thurso, J0X 3B0	Quebec	1	Final Effluent	Ottawa River
QC23	Kruger: Gatineau, QC	20 Laurier St, Gatineau, J8X 4H3	Quebec	1	Final Effluent	Ottawa River
QC24	Resolute Forest Products: Amos, QC	801 Rue des Papetiers, Amos, J9T 3X5	Quebec	1	Final Effluent	Harricana River
QC25	Rayonier: Témiscaming, QC	33 Chemin Kipawa, Temiscaming, J0Z 3R0	Quebec	3	Final Effluent - North-South (4EF) Final Effluent - Biological Treatment (3-EF) Final Cooling Water Effluent - Gordon Creek (61-ER)	Ottawa River

ID	COMPANY: MILL NAME	LOCATION	PROVINCE	NUMBER OF OUTFALLS	OUTFALL NAME	RECEIVING ENVIRONMENT[6]
QC26	Resolute Forest Products: Baie-Comeau, QC	20 Avenue Marquette , Baie Comeau, G4Z 1K6	Quebec	1	Final Effluent	Saint-Lawrence River
QC27	Nordic Kraft: Lebel-sur-Quévillon, QC	30 Chemin du Moulin, Lebel-sur-Quévillon, J0Y 1X0	Quebec	2	Final Effluent - 01 - EF	Quévillon River
					Final Cooling Water Effluent - 01	
QC28	Sustana Fiber: Breakyville, QC	3805 St. Augustin Avenue, Breakeyville, G0S 1E2	Quebec	1	Final	Chaudière River
QC29	Kruger: Crabtree, QC	100 1re Av, Crabtree, J0K 1B0	Quebec	1	Final Effluent Municipal Treatment	Ouareau River
QC30	Cascades: Lachute, QC	115 Rue Princesse, Lachute, J8H 4M3	Quebec	2	Final Effluent - with Combination	Rivière Du Nord
					Final Effluent - without Combination	
QC31	Enterprises Rolland: St. Jerome, QC	256 Jean-Baptiste-Rolland Blvd., Saint-Jerome, J7Y 3Z7	Quebec	1	Final Effluent	Rivière Du Nord
AB01	Alberta Newsprint: Whitecourt, AB	Postal Bag 9000 10km West, Hwy 43, Whitecourt, T7S 0A1	Alberta	1	Polishing Basin Outlet (Pumphouse)	Athabasca River
AB02	Alberta Pacific Forest Industries: Boyle, AB	Range Road 195A, Boyle, T0A 0M0	Alberta	1	PF-140119	Athabasca River
AB03	Mercer Celgar: Peace River, AB	1 Pulp Mill Site Road, Peace River, T8S 1V7	Alberta	2	Post Aeration Chamber (PAC)	Peace River
					Combined Chiller-Cooling Water	
AB05	Millar Western: Whitecourt, AB	5004 52 St, Whitecourt, T7S 1N2	Alberta	2	218 Final Effluent	Athabasca River
					Non-Contact Cooling Water (NCCW)	
AB06	West Fraser: Slave Lake, AB	East, W Mitsue Ind Rd, Slave Lake, T0G 2A0	Alberta	1	Reaeration Discharge	Lesser Slave River
AB07	International Paper: Grande Prairie, AB	Grande Prairie County No. 1, Grande Prairie, T8V 3A9	Alberta	1	Final Effluent Outfall	Wapiti River
AB08	West Fraser: Hinton, AB	760 Switzer Drive, Hinton, T7V 1V7	Alberta	1	Combined Final Effluent	Athabasca River
MB02	Canadian Kraft Paper Industries: The Pas, MB	MB-285, The Pas, R9A 1L4	Manitoba	1	Lagoon Outfall	Saskatchewan River
NB01	AV Group: Atholville, NB	175 Mill Ch., Atholville, E3N 4S7	New Brunswick	3	Final Effluent Parshall Flume	Restigouche River
					Storm Sewer East	
					Storm Sewer South	
NB03	Twin Rivers Paper: Edmunston, NB	27 Rue Rice, Edmunston, E3V 1S9	New Brunswick	3	Final Effluent	Saint John River
					Groundwood Mill Grinder	Madawaska River
					Surface Condenser	Madawaska River

ID	COMPANY: MILL NAME	LOCATION	PROVINCE	NUMBER OF OUTFALLS	OUTFALL NAME	RECEIVING ENVIRONMENT[6]
NB06	Irving (Paper): Saint John, NB	435 Bayside Drive, Saint John, E2J 1B2	New Brunswick	3	ASB Final to Courtenay Bay	Courtenay Bay
					Chip Yard Storm Sewer	
					Wetwell Emergency Outfall	
NB07	Irving (Pulp and Paper): Saint John, NB	408 Mill Road, Saint John, E2M 3H1	New Brunswick	5	Cooling Water	Saint John River
					Finishing Room	
					Hog and Press	
					Main Mill	
					Tissue Mill	
NB08	Irving: Lake Utopia, NB	600 NB-785, Utopia, E5C 2K4	New Brunswick	1	Parshall Flume	L'Étang Estuary
NB09	AV Group: Nackawic, NB	103 Pinder Road, Nackawic, E6G 1W4	New Brunswick	1	Effluent Discharge to Saint John River	Saint John River
NF03	Kruger: Corner Brook, NF	1 Mill Road, Corner Brook, A2H 6B9	Newfoundland	3	Combined West Sewer	Humber Arm
					East Sewer	
					Main AST Outfall	
NS01	Maibec: East River, NS	2005 Highway 3, East Chester, B0J 1T0	Nova Scotia	1	Rous Point	Little East River
NS03	CKF Incorporated: Hansport, NS	48 Prince Street, Hantsport, B0P 1P0	Nova Scotia	1	CKF Outfall	Avon River
NS04	Paper Excellence: Northern Pulp, NS	260 Granton Abercrombie Branch Road, Pictou County , B2H 5E8	Nova Scotia	2	Northern Pulp Nova Scotia Outfall (Point C)	Boat Harbour Basin
					Point D	Northumberland Straight
NS06	Port Hawkesbury Paper: Port Hawkesbury, NS	120 Pulp Mill Road, Port Hawkesbury, B9A 1A1	Nova Scotia	2	Clearwell	Strait Of Canso
					Main	
ON05	Domtar: Dryden, ON	1 Duke Street, Dryden, P8N 2Z7	Ontario	3	Final Effluent	Wabigoon River
					Pumphouse Cooling Water	
					Standpipe Creek Cooling Water	
ON06	Resolute Forest Products: Thunder Bay, ON	2001 Neebing Avenue, Thunder Bay, P7E 6S3	Ontario	3	Combined Mill	Kaministiquia River
					Kraft Clean Water	
					News Clean Water	

ID	COMPANY: MILL NAME	LOCATION	PROVINCE	NUMBER OF OUTFALLS	OUTFALL NAME	RECEIVING ENVIRONMENT[6]
ON07	Bioveld Canada: Thorold, ON	2 Allanburg Road, Thorold, L2V 3Z5	Ontario	1	Combined Effluent	Welland Canal
ON11	Cascades: Trenton, ON	300 Marmora Street, Trenton, K8V 5R8	Ontario	1	Total Mill Effluent	Trent River
ON12	Domtar: Espanola, ON	1 Station Road, Espanola, P5E 1R6	Ontario	2	Main Sewer Warm Water Tank Overflow	Spanish River
ON15	Dunn Paper: St. Catharines, ON	45 Merritt Street, St. Catharines, L2T 1J4	Ontario	1	Polishing Basin	Welland Canal
ON17	AV Group: Terrace Bay, ON	21 Mill Road, Terrace Bay, P0T 2W0	Ontario	3	Backflush Cooling Water Final Effluent	Lake Superior
ON21	Rayonier: Kapuskasing, ON	1 Government Road E, Kapuskasing, P5N 2Y2	Ontario	1	Combined Effluent Outfall	Kapuskasing River
ON23	Sonoco: Trent Valley, ON	Trenton Frankford Road, Trenton, K0K 2C0	Ontario	1	Final Effluent	Trent River
ON24	Strathcona Paper: Napanee, ON	77 County Road 16 R.R. #7 , Napanee, K7R 3L2	Ontario	4	Boiler Room Raw Water Drain (Cooling Water #2) Cooling Water (CW1) Final Process Effluent Raw Water Drain (Cooling Water #1)	Napanee River
PY01	Catalyst: Crofton, BC	8541 Hay Road, Crofton, V0R 1R0	British Columbia	2	Catalyst Paper (1) at Crofton Catalyst Paper (2) at Crofton	Stuart Channel
PY02	Paper Excellence: Howe Sound, BC	3838 Port Mellon Highway, Port Mellon, V0N 2S0	British Columbia	2	Howe Sound Pulp and Paper (1) at Port Mellon Howe Sound Pulp and Paper (2) at Port Mellon	Thornbrough Channel
PY05	Catalyst: Port Alberni, BC	4000 Stamp Avenue, Port Alberni, V9Y 5J7	British Columbia	1	Catalyst Paper at Port Alberni	Alberni Inlet
PY07	Catalyst: Powell River, BC	5775 Ash Avenue, Powell River, V8A 4R3	British Columbia	5	Catalyst Paper (1) at Powell River Catalyst Paper (2) at Powell River Catalyst Paper (3) at Powell River Catalyst Paper (4) at Powell River Catalyst Paper (5) at Powell River (Virtual)	Malaspina Strait

ID	COMPANY: MILL NAME	LOCATION	PROVINCE	NUMBER OF OUTFALLS	OUTFALL NAME	RECEIVING ENVIRONMENT[6]
PY12	Paper Excellence: Mackenzie, BC	1000 Coquawaldy Road, Mackenzie, V0J 2C0	British Columbia	2	MacKenzie Pulp (1) at MacKenzie	Williston Lake
					MacKenzie Pulp (2) at MacKenzie	Williston Lake
PY13	Cariboo Pulp and Paper: Quesnel, BC	50 North Star Road, Quesnel, V2J 3J6	British Columbia	1	Cariboo Pulp and Paper at Quesnel	Fraser River
PY14	Paper Excellence: Skookumchuck, BC	4501 Farstad Way, Skookumchuck, V0B 2E0	British Columbia	1	Tembec Pulp and Paper at Skookumchuk	Kootenay River
PY17	Canfor - Northwood Pulp: Prince George, BC	5353 Northwood Pulp Road, Prince George, V2L 4W2	British Columbia	1	Northwood Pulp and Timber at Prince George	Fraser River
PY18	Mercer Celgar: Castlegar, BC	1921 Arrow Lakes Drive, Castlegar, V1N 3H9	British Columbia	1	Celgar Pulp at Castlegar	Columbia River
PY19	Canfor - PGI: Prince George, BC	2533 Prince George Pulpmill Road, Prince George, V2N 2K3	British Columbia	1	Canadian Forest Products at Prince George	Fraser River
PY20	Quesnel River Pulp: Quesnel, BC	1000 Finning Road, Quesnel, V2J 6A1	British Columbia	1	Quesnel River Pulp at Quesnel	Fraser River
PY21	Kruger: New Westminster, BC	1625 5th Avenue, New Westminster, V3M 1Z7	British Columbia	1	Kruger Products Limited at New Westminster	Fraser River Estuary
PY22	Kruger: Kamloops, BC	2005 Mission Flats Road, Kamloops, V2C 1A9	British Columbia	1	Domtar at Kamloops	Thompson River
PY25	Canfor: Taylor, BC	8300 Cherry Avenue East, Taylor, V0C 2K0	British Columbia	1	Taylor Pulp and Paper at Taylor	Peace River
PY26	Nanaimo Forest Products: Harmac, BC	1000 Wave Place, Nanaimo, V9X 1J2	British Columbia	1	Harmac Pulp at Nanaimo	Northumberland Channel

APPENDIX B: ANNUAL EFFLUENT DATA FOR CANADIAN DIRECT DEPOSIT MILLS SUBJECT TO THE PPER (2021)

ID	MILL NAME	ANNUAL EFFLUENT FLOW (1000 m^3)	ANNUAL SS (tonnes)	ANNUAL BOD (tonnes)	ANNUAL *DAPHNIA MAGNA* FAILURES	ANNUAL *DAPHNIA MAGNA* TESTS	ANNUAL ACUTE LETHALITY FAILURES	ANNUAL ACUTE LETHALITY TESTS
QC01	Rayonier: Matane, QC	6950	380	142	2	52	0	14
QC02	Papiers White Birch - F.F. Soucy: Riviere-du-Loup, QC	5474	358	149	7	49	0	20
QC03	Cascades: Cabano, QC	2609	19	19	0	56	2	17
QC04	Resolute Forest Products: Alma, QC	11234	303	101	0	52	0	15
QC05	Resolute Forest Products: Kénogami, QC	6090	85	35	0	52	0	12
QC06	Fibrek : Saint-Félicien, QC	28630	920	919	1	83	0	22
QC07	Resolute Forest Products: Dolbeau, QC	7392	140	34	0	52	0	12
QC08	BP Canada: Pont Rouge, QC	570	17	7	0	52	0	12
QC09	MPI Moulin: Portneuf, QC	487	25	29	6	42	3	24
QC10	Papiers White Birch: Stadacona, QC	23859	506	467	2	52	0	15
QC11	Resolute Forest Products: Clermont, QC	7542	90	65	0	52	0	12
QC12	Cascades: Kingsey Falls, QC	1910	13	7	0	52	0	13
QC14	Westrock: La Tuque, QC	40675	1256	340	0	52	0	12
QC15	Kruger - Wayagamack: Trois-Rivières, QC	24203	799	130	0	154	0	36
QC16	Kruger: Trois-Rivières, QC	17108	192	56	1	52	0	12
QC17	Domtar: Windsor, QC	23948	932	284	0	52	0	13
QC18	Kruger: Brompton, QC	2428	22	10	0	52	0	12
QC19	Kruger: Sherbrooke, QC	875	8	23	1	51	1	16
QC20	Resolute Forest Products: Gatineau, QC	15932	299	151	0	52	0	12
QC21	Papiers White Birch - Papiers Masson: Gatineau, QC	7078	124	55	1	52	0	12
QC22	Fortress Specialty Cellulose: Thurso, QC	10776	32	27	0	20	0	12
QC23	Kruger: Gatineau, QC	5142	58	115	2	53	2	20
QC24	Resolute Forest Products: Amos, QC	0	0	0	0	0	0	0
QC25	Rayonier: Témiscaming, QC	52580	1088	434	2	137	0	46
QC26	Resolute Forest Products: Baie-Comeau, QC	0	0	0	0	0	0	0
QC27	Nordic Kraft: Lebel-sur-Quévillon, QC	34049	497	215	3	97	2	35
QC28	Sustana Fiber: Breakyville, QC	527	31	7	6	49	2	21
QC29	Kruger: Crabtree, QC	6095	28	13	0	51	0	12
QC30	Cascades: Lachute, QC	430	32	15	3	52	5	20
QC31	Enterprises Rolland: St. Jerome, QC	2888	654	145	1	52	0	13

ID	MILL NAME	ANNUAL EFFLUENT FLOW (1000 m^3)	ANNUAL SS (tonnes)	ANNUAL BOD (tonnes)	ANNUAL *DAPHNIA MAGNA* FAILURES	ANNUAL *DAPHNIA MAGNA* TESTS	ANNUAL ACUTE LETHALITY FAILURES	ANNUAL ACUTE LETHALITY TESTS
AB01	Alberta Newsprint: Whitecourt, AB	5585	67	30	0	52	0	12
AB02	Alberta Pacific Forest Industries: Boyle, AB	30089	418	73	0	51	0	12
AB03	Mercer Celgar: Peace River, AB	21585	978	191	2	106	2	29
AB05	Millar Western: Whitecourt, AB	5545	315	200	2	71	1	30
AB06	West Fraser: Slave Lake, AB	4192	290	101	0	52	0	12
AB07	International Paper: Grande Prairie, AB	15202	368	297	0	53	0	13
AB08	West Fraser: Hinton, AB	36272	1014	577	1	53	0	14
MB02	Canadian Kraft Paper Industries: The Pas, MB	12924	480	297	1	57	2	20
NB01	AV Group: Atholville, NB	16835	1285	1355	0	60	1	23
NB03	Twin Rivers Paper: Edmunston, NB	23123	1652	735	2	61	0	25
NB06	Irving (Paper): Saint John, NB	11910	3350	675	4	52	0	16
NB07	Irving (Pulp and Paper): Saint John, NB	43001	2721	2169	2	134	0	33
NB08	Irving: Lake Utopia, NB	6475	345	313	0	52	5	20
NB09	AV Group: Nackawic, NB	25094	728	450	0	48	0	11
NF03	Kruger: Corner Brook, NF	24203	421	133	0	106	0	26
NS01	Maibec: East River, NS	564	86	21	0	52	1	16
NS03	CKF Incorporated: Hansport, NS	1938	6	64	0	54	0	13
NS04	Paper Excellence: Northern Pulp, NS	Not Operational in 2021						
NS06	Port Hawkesbury Paper: Port Hawkesbury, NS	6992	293	58	0	52	0	12
ON05	Domtar: Dryden, ON	37159	704	755	0	52	0	12
ON06	Resolute Forest Products: Thunder Bay, ON	47101	1148	422	1	156	0	36
ON07	Bioveld Canada: Thorold, ON	3116	6	5	0	52	0	12
ON11	Cascades: Trenton, ON	1410	6	4	0	52	0	12
ON12	Domtar: Espanola, ON	34018	1454	662	0	53	0	12
ON15	Dunn Paper: St. Catharines, ON	2269	13	31	0	52	0	12
ON17	AV Group: Terrace Bay, ON	37240	1239	863	0	54	1	17
ON21	Rayonier: Kapuskasing, ON	12725	106	48	1	53	0	15
ON23	Sonoco: Trent Valley, ON	Not Operational in 2021						
ON24	Strathcona Paper: Napanee, ON	555	6	5	0	52	0	12
PY01	Catalyst: Crofton, BC	55455	1698	501	0	58	0	18
PY02	Paper Excellence: Howe Sound, BC	24606	386	169	1	73	0	29

ID	MILL NAME	ANNUAL EFFLUENT FLOW (1000 m^3)	ANNUAL SS (tonnes)	ANNUAL BOD (tonnes)	ANNUAL *DAPHNIA MAGNA* FAILURES	ANNUAL *DAPHNIA MAGNA* TESTS	ANNUAL ACUTE LETHALITY FAILURES	ANNUAL ACUTE LETHALITY TESTS
PY05	Catalyst: Port Alberni, BC	26151	377	262	0	52	0	12
PY07	Catalyst: Powell River, BC	52941	197	140	1	108	2	65
PY12	Paper Excellence: Mackenzie, BC	47	1	0	0	15	0	7
PY13	Cariboo Pulp and Paper: Quesnel, BC	32319	1830	739	1	52	0	13
PY14	Paper Excellence: Skookumchuck, BC	13965	433	335	0	52	0	12
PY17	Canfor - Northwood Pulp: Prince George, BC	46814	3930	1798	0	52	0	12
PY18	Mercer Celgar: Castlegar, BC	49352	773	149	0	52	0	13
PY19	Canfor - PGI: Prince George, BC	42834	3609	1379	0	52	0	12
PY20	Quesnel River Pulp: Quesnel, BC	7105	2004	657	5	55	0	19
PY21	Kruger: New Westminster, BC	2734	127	57	0	59	0	11
PY22	Kruger: Kamloops, BC	35341	803	805	0	52	0	13
PY25	Canfor: Taylor, BC	5003	357	72	1	49	0	13
PY26	Nanaimo Forest Products: Harmac, BC	53301	2034	456	1	58	0	19

APPENDIX C: EFFECT DESIGNATIONS AND SLT VALUES FOR CANADIAN MILLS IN OPERATION

ID	COMPANY: MILL NAME	GEOMETRIC MEAN IC_{25} SUBLETHAL TOXICITY[7] (2010 TO 2021)		MILL EFFECT DESIGNATIONS (*As of 2019*)			
		Algae	Invertebrate	Overall	Fish Habitat	Fish Population	Fish Tissue
QC01	Sappi: Matane, QC	4.04	7.85	effect	no effect	effect	no effect
QC02	Papiers White Birch - F.F. Soucy: Rivière-du-Loup, QC	33.14	23.70	effect	effect	effect	no effect
QC03	Cascades: Cabano, QC	100.00	62.10	effect	effect	effect	no effect
QC04	Resolute Forest Products: Alma, QC	11.19	14.75	effect	effect	effect	no effect
QC05	Resolute Forest Products: Kénogami, QC	77.20	22.61	effect	effect	no effect	no effect
QC06	Fibrek : Saint-Félicien, QC	52.09	26.05	effect	effect	effect	no effect
QC07	Resolute Forest Products: Dolbeau, QC	100.00	83.90	monitoring not required			no effect
QC08	BP Canada: Pont Rouge, QC	76.96	89.90	monitoring not required			no effect
QC09	MPI Moulin: Portneuf, QC	63.28	26.19	effect	effect	effect	no effect
QC10	Papiers White Birch: Stadacona, QC	47.59	70.02	monitoring not required			no effect
QC11	Resolute Forest Products: Clermont, QC	100.00	78.37	effect	effect	effect	no effect
QC12	Cascades: Kingsey Falls, QC	63.03	59.09	effect	effect	effect	no effect
QC14	Westrock: La Tuque, QC	87.99	74.31	effect	effect	effect	no effect
QC15	Kruger - Wayagamack: Trois-Rivières, QC	60.40	69.61	monitoring not required			no effect
QC16	Kruger: Trois-Rivières, QC	79.29	80.73	monitoring not required			no effect
QC17	Domtar: Windsor, QC	93.30	59.36	effect	effect	effect	no effect
QC18	Kruger: Brompton, QC	85.28	72.34	effect	effect	effect	no effect
QC19	Kruger: Sherbrooke, QC	64.46	10.17	effect	effect	studies inconclusive	no effect
QC20	Resolute Forest Products: Gatineau, QC	97.51	70.11	effect	effect	effect	no effect
QC21	Papiers White Birch - Papiers Masson: Gatineau, QC	88.48	54.12	effect	effect	effect	no effect

[7] This value represents the effluent concentration that causes a 25% reduction in growth or reproduction in test organisms, known as the *inhibiting concentration (IC_{25}).* If a 100% concentration of effluent causes less than a 25% inhibition, the effluent is reported as showing no sublethal toxicity for that test.

ID	COMPANY: MILL NAME	GEOMETRIC MEAN IC_{25} SUBLETHAL TOXICITY[7] (2010 TO 2021)		MILL EFFECT DESIGNATIONS (*As of 2019*)			
		Algae	Invertebrate	Overall	Fish Habitat	Fish Population	Fish Tissue
QC22	Fortress Specialty Cellulose: Thurso, QC	62.11	73.42	effect	effect	effect	no effect
QC23	Kruger: Gatineau, QC	86.98	21.19	monitoring not required			no effect
QC24	Resolute Forest Products: Amos, QC	84.76	51.64	effect	effect	effect	no effect
QC25	Rayonier: Témiscaming, QC	88.18	38.50	effect	effect	effect	no effect
QC26	Resolute Forest Products: Baie-Comeau, QC	20.79	56.08	effect	effect	effect	no effect
QC27	Nordic Kraft: Lebel-sur-Quévillon, QC	64.19	92.95	not operational in 2019			
QC28	Sustana Fiber: Breakyville, QC	40.12	25.62	effect	effect	effect	no effect
QC29	Kruger: Crabtree, QC	95.70	75.32	effect	effect	effect	no effect
QC30	Cascades: Lachute, QC	73.46	24.88	effect	effect	monitoring not required	no effect
QC31	Enterprises Rolland: St. Jerome, QC	68.66	11.68	effect	effect	effect	no effect
AB01	Alberta Newsprint: Whitecourt, AB	62.98	34.71	effect	effect	monitoring not required	no effect
AB02	Alberta Pacific Forest Industries: Boyle, AB	96.86	49.36	effect	effect	effect	no effect
AB03	Mercer Celgar: Peace River, AB	70.50	39.85	monitoring not required			no effect
AB05	Millar Western: Whitecourt, AB	23.06	14.29	effect	effect	monitoring not required	no effect
AB06	West Fraser: Slave Lake, AB	17.19	18.44	no effect	no effect	monitoring not required	no effect
AB07	International Paper: Grande Prairie, AB	91.18	29.17	effect	effect	effect	no effect
AB08	West Fraser: Hinton, AB	92.96	31.45	effect	no effect	effect	no effect
MB02	Canadian Kraft Paper Industries: The Pas, MB	100.00	27.46	effect	effect	effect	no effect
NB01	AV Group: Atholville, NB	1.20	1.57	effect	effect	studies inconclusive	no effect
NB03	Twin Rivers Paper: Edmunston, NB	44.72	17.66	effect	effect	effect	no effect
NB06	Irving (Paper): Saint John, NB	16.17	74.76	effect	effect	studies inconclusive	no effect
NB07	Irving (Pulp and Paper): Saint John, NB	6.14	7.54	effect	studies inconclusive	studies inconclusive	no effect
NB08	Irving: Lake Utopia, NB	1.08	1.31	effect	studies inconclusive	effect	no effect
NB09	AV Group: Nackawic, NB	85.97	28.80	effect	effect	effect	no effect
NF03	Kruger: Corner Brook, NF	24.07	15.22	effect	effect	effect	no effect
NS01	Maibec: East River, NS	5.22	3.74	monitoring not required			no effect
NS03	CKF Incorporated: Hansport, NS	20.25	59.93	monitoring not required			no effect
NS04	Paper Excellence: Northern Pulp, NS	not operational in 2021		effect	effect	effect	no effect

ID	COMPANY: MILL NAME	GEOMETRIC MEAN IC_{25} SUBLETHAL TOXICITY[7] (2010 TO 2021)		MILL EFFECT DESIGNATIONS (*As of 2019*)			
		Algae	Invertebrate	Overall	Fish Habitat	Fish Population	Fish Tissue
NS06	Port Hawkesbury Paper: Port Hawkesbury, NS	9.51	31.13	effect	effect	effect	no effect
ON05	Domtar: Dryden, ON	80.45	32.48	effect	effect	effect	no effect
ON06	Resolute Forest Products: Thunder Bay, ON	54.67	58.27	effect	effect	effect	no effect
ON07	Bioveld Canada.: Thorold, ON	not operational in 2021					
ON11	Cascades: Trenton, ON	monitoring not required					no effect
ON12	Domtar: Espanola, ON	97.85	60.28	effect	effect	effect	no effect
ON15	Dunn Paper: St. Catharines, ON	89.81	32.28	effect	effect	effect	no effect
ON17	AV Group: Terrace Bay, ON	59.31	27.71	effect	effect	effect	no effect
ON21	Rayonier: Kapuskasing, ON	80.49	54.94	effect	effect	effect	no effect
ON23	Sonoco: Trent Valley, ON	not operational in 2021		monitoring not required			no effect
ON24	Strathcona Paper: Napanee, ON	93.87	67.78	effect	effect	effect	no effect
PY01	Catalyst: Crofton, BC	9.62	14.50	effect	effect	effect	effect
PY02	Paper Excellence: Howe Sound, BC	8.12	16.20	effect	effect	no effect	no effect
PY05	Catalyst: Port Alberni, BC	6.78	26.28	effect	effect	no effect	no effect
PY07	Catalyst: Powell River, BC	17.41	46.38	effect	effect	monitoring not required	no effect
PY12	Paper Excellence: Mackenzie, BC	not operational in 2021		effect	effect	monitoring not required	no effect
PY13	Cariboo Pulp and Paper: Quesnel, BC	100.00	52.19	effect	no effect	effect	no effect
PY14	Paper Excellence: Skookumchuck, BC	80.22	28.56	effect	effect	effect	no effect
PY17	Canfor - Northwood Pulp: Prince George, BC	98.72	61.75	effect	no effect	effect	no effect
PY18	Mercer Celgar: Castlegar, BC	97.03	75.91	no effect	no effect	no effect	no effect
PY19	Canfor - PGI: Prince George, BC	85.81	44.25	effect	no effect	effect	no effect
PY20	Quesnel River Pulp: Quesnel, BC	2.05	26.73	monitoring not required			no effect
PY21	Kruger: New Westminster, BC	94.03	62.65	monitoring not required			no effect
PY22	Kruger: Kamloops, BC	98.86	72.76	effect	effect	effect	no effect
PY25	Canfor: Taylor, BC	51.50	44.50	monitoring not required			no effect
PY26	Nanaimo Forest Products: Harmac, BC	3.51	6.59	effect	effect	monitoring not required	no effect

LIST OF ACRONYMS AND ABBREVIATIONS

BOD	biochemical oxygen demand
EEM	environmental effects monitoring
kT	kilo tonnes
PPER	*Pulp and Paper Effluent Regulations*
SS	suspended solids