

2.0 ACTIVITIES IN THE RAMP FOCUS STUDY AREA IN 2008

2.1 BACKGROUND

Each year, oil sands and related development activities in the Athabasca oil sands region continue to increase and change. From a monitoring perspective, it is important to have a complete record and understanding of these development activities that have occurred during a given monitoring year. This information is needed to interpret monitoring results within the context of actual development activities and operations, and the potential influence of these activities on the surrounding environment.

For RAMP, oil sands and related development activities that may alter or influence local aquatic environments are of specific importance. Activities such as land clearing and construction, muskeg dewatering, alteration of drainage patterns, air emissions, water discharges and withdrawals all have the potential to affect aquatic resources in receiving waters.

This section provides a synthesis of information related to development that may be influencing aquatic environmental resources within the RAMP Focus Study Area (FSA), and describes relevant activities that occurred in 2008 in the focal projects (i.e., those projects within the RAMP FSA owned by 2008 RAMP funders which were under construction or operational in 2008, described below in Section 2.2).

Table 2.2-1 summarizes the status of all projects as of the end of 2008 in the RAMP FSA owned by RAMP funders. The year of first environmental disturbance of each project has also been included where possible because this represents the first year in which project activities have the potential to affect local aquatic systems (i.e., conservative approach).

In addition, a list of approved oil sands projects within the RAMP FSA owned by companies that were not funders of RAMP in 2008 is also provided (Section 2.3).

The information pertaining to these projects was obtained from:

- publications from the Energy Resources Conservation Board (ERCB) on active oil sands schemes (ERCB 2008);
- field observations during RAMP monitoring surveys;
- information provided by industry representatives of RAMP;
- an analysis of spring and summer 2008 satellite imagery for estimation of land change in the RAMP FSA; and
- information found on RAMP-member and other company websites.

2.2 FOCAL PROJECT ACTIVITIES IN 2008

2.2.1 Suncor Energy Inc.

Suncor's projects in the RAMP FSA in 2008 were Lease 86/17 and 23, the Steepbank Mine, the Millennium Mine, the Voyageur Upgrader, the Firebag Project, the North Steepbank Mine and associated expansions, tailings ponds and other facilities. Activities in 2008 included:

Table 2.2-1 Status and activities of developments owned by 2008 RAMP-funders in the RAMP Focus Study Area.

2008 RAMP Funder	Development	Focal Projects	Location		Type of Operation	Capacity ¹	Year of Application	Year of First Disturbance	2008 Status
			Oil Sands Leases	Township and Range					
Suncor Energy Inc.	Lease 86/17	√	Lease 86, Lease 17	23-92-10-W4M	mine	280,000	1964	1967	No Mining
	Steepbank Mine	√	Leases 97, 19, 25 and Fee Lots 1 and 3	91-9-W4M and 92-9-W4M	mine		1996	1997	Operational
	Millennium Mine	√	Leases 25, 19 and Fee Lots 3 and 4	91,92-9-W4M	mine		1998	2000	Operational
	Millennium Upgrader and Expansion	√	Lease 86, Lease 17, Lease 23	92-10-W4M		300,000	1998	2000	Operational
	South Tailings Pond	√	Lease 25, Lease 19	90,91-8-W4M, 91-9-W4M			2003	2005	Construction
	Firebag	√	Lease 85	19, 20, 29 to 32-94-5-W4M; 22 to 36-94-6-W4M; W25 36-94-7-W4M; 6 to 8, 17 to 20, 29 to 32-95-5-W4M; 95-6-W4M; 4 to 6-96-6-W4M	<i>in situ</i>	280,000	2000	2002	Operational
	Voyageur: North Steepbank Mine Extension	√	Lease 25, Lease 97, Fee Lot 1	92,93-9-W4M	mine	180,000	2005	2007	Construction
Syncrude Canada Ltd.	Voyageur: Voyageur Upgrader	√	Fee Lot 2, Lease 23	91,92-10-W4M		550,000 ²	2005	2007	Construction
	Mildred Lake	√	Lease 17, Lease 22	6-93-10-W4M	mine	250,000	1973	1973	Operational
	Aurora North	√	Lease 10, Lease 12, Lease 34	96-9,10,11-W4M	mine	200,000	1996	1996	Operational
	Mildred Lake Upgrader and Expansion	√	Lease 17, Lease 22	6-93-10-W4M		350,000	1998	existing area	Operational
Albian Sands Energy Inc. ³	Muskeg River Mine	√	Lease 13	95-10-W4M	mine	155,000	1997	2000	Operational
	Muskeg River Mine Expansion	√	Lease 13, Lease 90	95-8,9-W4M, 94-10-W4M	mine	115,000	2005	2007	Construction
Shell Canada Limited ³	Jackpine Mine (Phase 1)	√	Lease 13	95-8-W4, 95-9-W4	mine	200,000	2002	2006	Construction
	Jackpine Mine Expansion		Lease 13, Lease 88, 89, Lease 035, 631, AT36	95,96,97-9,8-W4M	mine	100,000	2007	-	Application
	Pierre River Mine		Lease 309, 310, 351, 352	97,98,99-10,11-W4M	mine	200,000	2007	-	Application
Canadian Natural	Horizon	√	Lease 18	96-11/12-W4M, 96-13-W4M, 97-11-W4M, 97-12-W4M, 97-13-W4M	mine	270,000	2002	2004	Operational
Imperial Oil Resources	Kearl	√	Leases 6, 87, 36 31A, 88	95,96,97-6-W4M, 95,96,97-7-W4M, 95,96,97-8-W4M	mine	300,000	2005	--	Approved
Petro-Canada	Dover	√	7187060328	93-12-W4M	<i>in situ</i>	900	unknown	unknown	Operational
	Fort Hills	√	7598060T05, 7281020T52, 7400120008	96-11-W4M, 97,98-10-W4M	mine	190,000	2001	2005	Construction
	MacKay River	√	7282030T75	92, 93-12-W4M	<i>in situ</i>	33,000	1998	2000	Operational
	MacKay River Expansion		7282030T75, 728004AT22, 7187060328	92, 93-12-W4M	<i>in situ</i>	40,000	2006	--	Approved
	Meadow Creek		7281010T58, 7283010T81	84,85-8,9,10-W4M	<i>in situ</i>	80,000	2001	--	Approved
OPTI Canada Inc./ Nexen Inc.	Long Lake Pilot	√	Lease 27	85-6-W4M	<i>in situ</i>	3,000	unknown	2003	Operational
	Long Lake Project (Phase 1, Upgrader)	√	Lease 27	84,85,86-6-W4M, 84,85,86,87-7-W4M	<i>in situ</i>	70,000	2003	2004	Operational
	Long Lake Project (Phase 2, Upgrader)								Approved
	Long Lake Project (Phase 2, SAGD Facilities)		Lease 27	84 6&7-W4M	<i>in situ</i>	70,000	2003	2004	Application
Total E&P Joslyn Ltd.	Joslyn, SAGD Phase I				<i>in situ</i>	600	unknown	2003	Under Closure
	Joslyn, SAGD Phase II	√	7280060T24, 7404110452, 7405070799	94,95,96-11-W4M, 94-12-W4M	<i>in situ</i>	10,000	2004	2005	Operational
	Joslyn, SAGD Phase III				<i>in situ</i>	15,000	2005	--	Application
	Joslyn North Mine Project				mine	100,000	2006	--	Application
	Northern Lights		Lease 15, Lease 16, Lease 789	98 and 99-5 to 7-W4M	mine	100,000	2006	--	Application
Husky Energy	Sunrise	√	728704AT87, 728103AT49, 740101A022, 740012A006, 7401100015, 7002080057, 742080006	94-97-6,7-W4M	<i>in situ</i>	200,000	2004	2007	Construction
Birch Mountain Resources Ltd.	Muskeg Valley Quarry	√	MAIM Leases 9494070001, 9494070002, 9403120367, 9499030555, and 9400080004	94,95-10-W4M	quarry	limestone product, 7 million t/yr	2004	2005	Operational
	Hammerstone Quarry		MAIM Leases 9494070001, 9494070002, 9403120367, 9499030555, and 9400080004	94-10-W4M	quarry	limestone product, 18 million t/yr	2006	--	Approved

Notes: Information in this table obtained from ERCB (2008), ERCB project approvals, project EIA documents, and company websites.

¹ Unless otherwise stated, units are in bpd.

² Suncor's total planned upgrading capacity once Voyageur begins operations.

³ Company names as of December 2008; as of January 2009, Shell Canada Limited and Albian Sands Energy Inc. became known as Shell Albian Sands.

- site drainage of approximately 0.03 million m³ of water from Lease 23;
- water discharge of approximately 0.04 million m³ of water from the temporary settling pond at the Voyageur Upgrader site to Ruth Channel;
- water discharge of approximately 0.008 million m³ of water from holding ponds at the Voyageur Upgrader to the Athabasca River; and
- withdrawal of approximately 45.9 million m³ of water from the Athabasca River.

2.2.2 Syncrude Canada Ltd.

Syncrude's active oil sands projects in the RAMP FSA in 2008 were the Mildred Lake Base Mines (East and North Mines), the associated Mildred Lake Upgrader and Upgrader Expansion, and the Aurora North Mine.

Syncrude Mildred Lake Mine and Upgrader

The Mildred Lake operation includes an open-pit oil sands mine, and extraction and upgrading facilities. In addition to ongoing oil sands production and upgrading activities, specific activities conducted for the Mildred Lake project in 2008 included:

- continued exploratory drilling at the Base Plant;
- 3.71 km² of land cleared in the Athabasca River and Muskeg River watersheds;
- withdrawal of 41.23 million m³ from the Athabasca River; and
- discharge of 0.234 million m³ of treated domestic sewage to the Athabasca River.

Syncrude Aurora North Mine

The Aurora North Mine is located north of the Albion Sands Muskeg River Mine and is within the Muskeg River watershed. The mine, which began production in 2000, consists of an open-pit mine and extraction operations. In addition to ongoing oil sands production activities, specific activities conducted by Syncrude for the Aurora North Mine in 2008 included:

- 1.86 km² of land cleared in the Athabasca River and Muskeg River watersheds; and
- a diversion of 2.53 million m³ of water to Stanley Creek as part of the Aurora Clean Water Diversion system.

2.2.3 Shell Canada Limited

Construction activities continued in 2008 on Shell's Jackpine Mine Phase 1 project; these activities included:

- exploratory drilling;
- land clearing in the Muskeg River watershed, with instream work in Shelley Creek and Khahago Creek in the first quarter (beaver dam removal);
- muskeg dewatering of 1,663 ha in Jackpine Creek, Shelley Creek and Khahago Creek watersheds; and
- release of water collected from site runoff and muskeg dewatering from settling ponds as follows: 1.4 million m³ of water discharged into Shelley Creek; 0.07 million m³ of water discharged into Jackpine Creek; and 0.09 million m³ of water discharged into Khahago Creek.

2.2.4 Albion Sands Energy Inc.

Albian Sands operates the Muskeg River Mine which consists of an open-pit mine and extraction plant. In 2008, the Albion Sands Muskeg River Mine facility was a zero water-discharge operation, with tailings water and local drainage being recycled for project operations. Specific activities conducted by Albion Sands in 2008 in regards to the Muskeg River Mine included:

- continued exploratory drilling;
- 291 ha of land cleared and 210 ha of land disturbed; no instream work was conducted; and
- water withdrawal from the Athabasca River totaling 13.5 million m³.

2.2.5 Canadian Natural Resources Ltd.

Construction activities continued in 2008 on the Canadian Natural Horizon project on Lease 18; these activities included:

- continued exploratory drilling;
- land clearing for a diversion ditch around the plant connecting the upper and lower portions of Tar River;
- instream work in the diversion ditch during all months of 2008 except April;
- alteration of the main channel drainage pattern of the Tar River to a diversion channel from the upper portion of the river to the compensation lake in January;
- construction of a diversion channel in May, from the upper Tar River to a tailings pond;
- water withdrawal of 17.6 million m³ from the Athabasca River; and
- water discharge from the wastewater treatment plant to the Tar River of 0.4 million m³.

2.2.6 Petro-Canada

Petro-Canada's active projects in the RAMP FSA in 2008 were the Fort Hills Project and the *in situ* MacKay River Project.

Petro-Canada Fort Hills

Activities undertaken on Petro-Canada's Fort Hills Project in 2008 included:

- ongoing exploratory drilling and land clearing;
- land clearing and project construction in Fort Creek, Creek A and Muskeg River watersheds, with instream work occurring in October in Fort Creek;
- muskeg dewatering activities from January to December in the Fort Creek and Creek A watersheds, and from April to November in the watershed of an unnamed creek; and
- discharge to Fort Creek of approximately 2.9 million m³ of settling pond water collected from site runoff and dewatering activities.

Petro-Canada MacKay River

Specific activities conducted by Petro-Canada in 2008 in regards to the MacKay River Project included:

- land clearing and project construction in the MacKay River watershed; and
- stormwater discharge of approximately 12,400 m³.

2.2.7 OPTI Canada Ltd./Nexen Inc.

OPTI Canada Ltd. and Nexen Inc. are jointly developing the *in situ* Long Lake Project, located near Anzac and the Gregoire River. Construction of Phase 1 of the Long Lake Project (*in situ* plus upgrader) was completed in 2008 with startup activities occurring throughout the year. Culvert installation occurred in one unnamed tributary to Gregoire River in August. Groundwater withdrawals for operations totalled approximately 1.9 million m³ in 2008.

2.2.8 Total E&P Joslyn Ltd.

Total E&P Joslyn Ltd. (Total E&P) operated the *in situ* Joslyn Phase II Project on Lease 24 in 2008. Specific activities conducted by Total E&P in regards to the Joslyn Phase II project included:

- exploratory drilling;
- land clearing and project construction in the Ells River watershed, with instream work occurring in the Athabasca River in January and February;
- water discharge of approximately 0.005 m³ from the industrial runoff pond; and
- groundwater withdrawals for the Phase II project of approximately 0.1 million m³.

2.2.9 Birch Mountain Resources Ltd.

Birch Mountain Resources Ltd. continued operation of its Muskeg Valley Quarry in 2008. The Hammerstone Quarry was approved in 2008 but no development has occurred to date on this project.

2.2.10 Husky Energy Inc.

Husky Energy Inc. continued construction of the Sunrise Thermal Project in 2008; activities included: exploratory drilling; land clearing; and project construction in the Wapasu Creek drainage. Approximately 0.07 million m³ of water was released from site run off in 2008 to Wapasu Creek.

2.2.11 Imperial Oil Resources

Specific activities conducted by Imperial Oil Resources in 2008 in regards to the Kearn Project included:

- exploratory drilling and land clearing in the Muskeg River watershed;
- muskeg dewatering activities from April to December, with a discharge of approximately 2.4 million m³ of water to the Muskeg River watershed; and
- water withdrawal of 0.02 million m³ from the Muskeg River and 0.004 million m³ from the Athabasca River in 2008.

2.3 NON-RAMP MEMBER OIL SANDS PROJECTS

There were eight approved oil sands development projects active in the RAMP FSA in 2008 whose operators were not members of RAMP in 2008. A brief summary of those operations is provided in Table 2.3-1.

Table 2.3-1 Approved Athabasca oil sands development projects within the RAMP study area operated by non-RAMP members, as of 2008.

Operator	Field or Area	Location (Township and Range)	Recovery Method
EnCana	Christina Lake	11 to 16,E17,24-76-6W4M, 1, 2-20-76-6W4M, 1 to 4-21-76-6W4M, 1 to 4-22-76-6W4M, 1 to 4-23-76-6W4M	SAGD
Japan Canada	Hangingstone	NW26, N27, N28, 33, 34, W35-84-11W4M	SAGD
ConocoPhillips	Surmont	24-83-7W4M	Steam Stimulation
Devon	Jackfish	19 to 21, 28 to 33-75-6W4M, 4 to 6-76-6W4M	SAGD
MEG Energy	Christina Lake	7 to 9, 16 to 18, N19 to N21-77-5W4, E12, E13, E24-77-6W4	SAGD
Petrobank Whitesands	Whitesands	12, 13-77-9W4M	Toe to Heel Air Injection
Statoil Canada Kai Kos Dehseh	Leismer Demonstration	19 to 21, 26, 28, 29 to 33-78-9W4M	SAGD
Connacher	Great Divide and Algar	NW16, NE17, SE20, 21-82-12W4	SAGD

Information obtained from ERCB (2008).

2.4 LAND CHANGE RELATED TO DEVELOPMENT ACTIVITIES IN 2008

Land change was estimated with satellite imagery in conjunction with more detailed maps of operations provided by a number of RAMP industry members. These sources of data were used to estimate the amount of land change for a number of land change classes in each of the main RAMP FSA watersheds in 2008.

A set of 4 SPOT-5 10m resolution images taken on 27 May, 12 July, and 8 and 23 August 2008 were obtained. A land change classification protocol was developed and applied to the imagery to identify and delineate two types of land change in 2008 from the projects listed in Table 2.2-1 and in Table 2.3-1: land change area that is not hydrologically closed-circuited; and land change area that is hydrologically closed-circuited. Because of the resolution of the satellite imagery, SAGD well pads were about the smallest oil sands development entity that was delineated. Details of the land change estimation procedure are provided in Appendix A. Drafts of the land change maps were provided to RAMP members for review, and recommendations for revision of the maps were used to produce the final set of 2008 land change maps.

Land change area as of 2008 is presented in Figure 2.4-1 and Figure 2.4-2 for north and south of Fort McMurray, respectively.

Figure 2.4-1 RAMP land change classes derived from SPOT-5 satellite imagery of May, July, and August 2008, north of Fort McMurray.

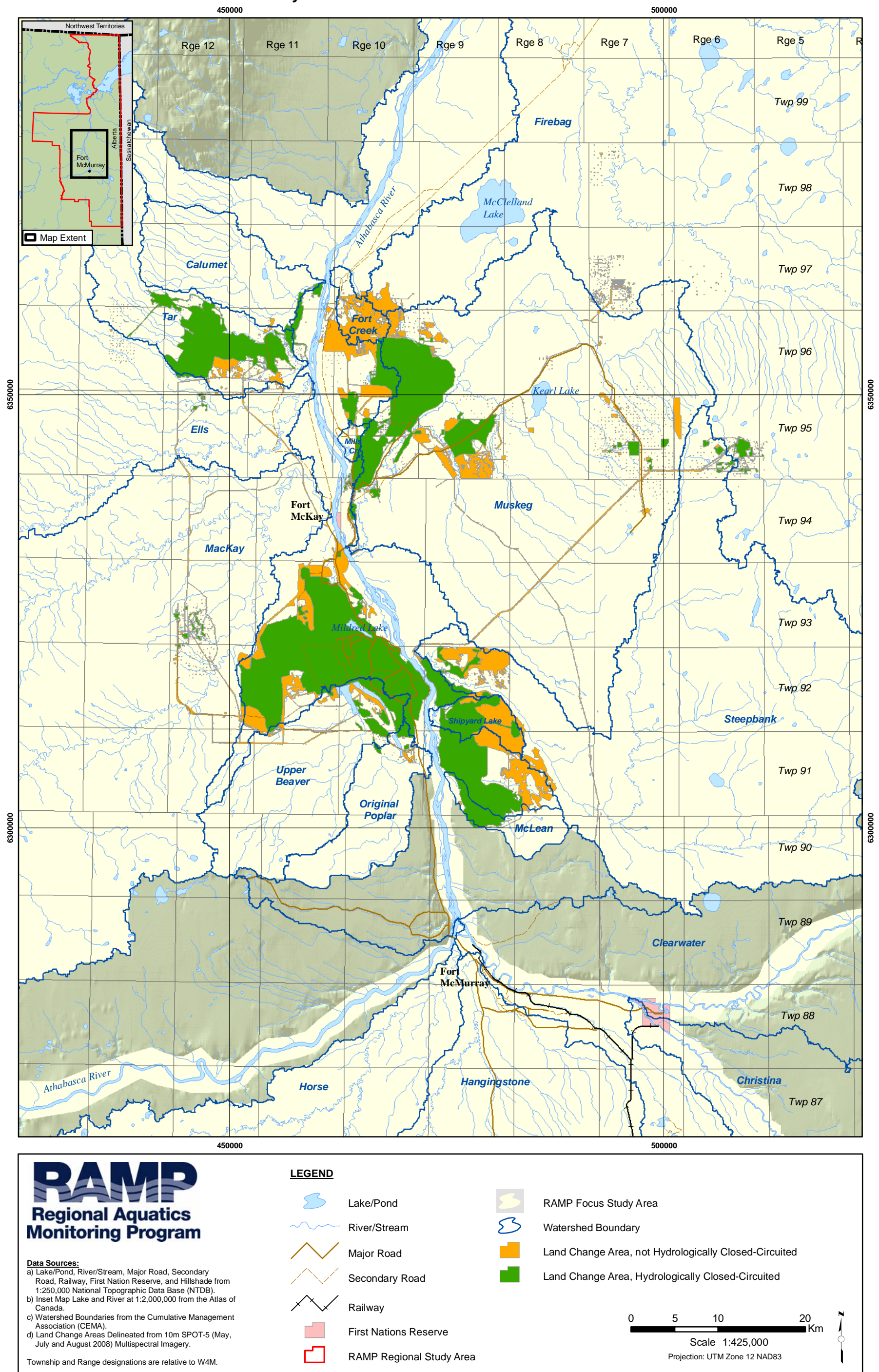


Figure 2.4-2 RAMP land change classes derived from SPOT-5 satellite imagery of July and August 2008, south of Fort McMurray.

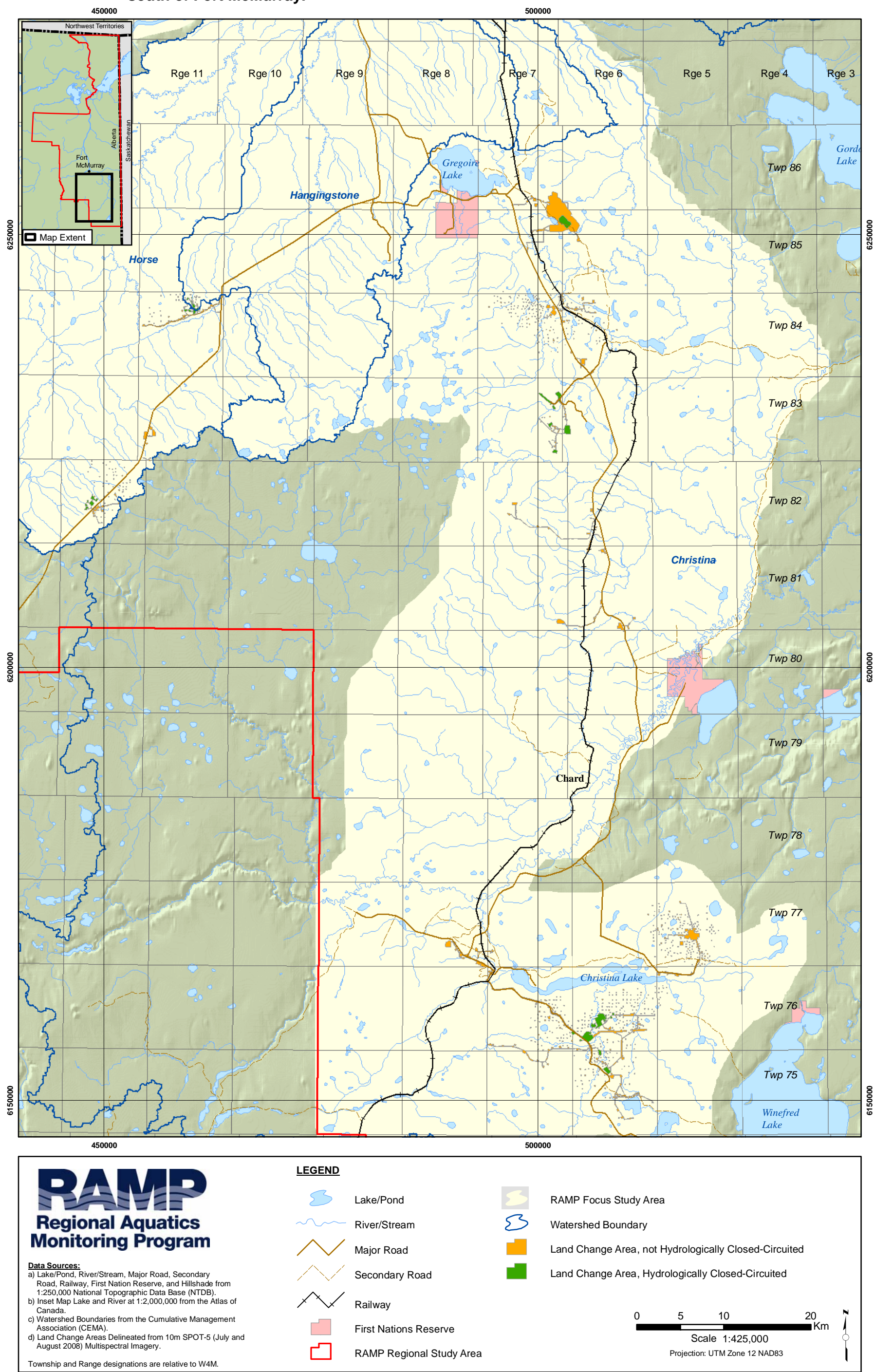


Table 2.4-1 and Table 2.4-2 provide tabular summaries of the land changes in each of the main watersheds by each land change type, for focal projects and non-RAMP oil sands projects within the RAMP FSA. Land change as of 2008 within the RAMP FSA is estimated at approximately 73,000 ha for focal projects and slightly more than 3,000 ha for oil sands projects operated by non-RAMP funding companies, for a total of slightly more than 76,000 ha. This represents approximately 2.2% of the area of the RAMP FSA. The percentage of the area of watersheds with land change as of 2008 varies from less than 1% for many watersheds (MacKay, Ells, Christina, Hangingstone, Horse, and Firebag), to 5% to 10% for the Muskeg and Upper Beaver watersheds, to more than 10% for the Fort Creek, Mills Creek, Tar, Shipyard Lake, and McLean Creek watersheds, as well as the smaller Athabasca River tributaries from Fort McMurray to the confluence of the Firebag River.

Table 2.4-1 Area of watersheds with land change in 2008.

Watershed	Total Watershed Area (ha)	Watershed Area with Land Change (ha)						Watershed Total
		Focal Projects		Other Oil Sands Projects in RAMP FSA		Total		
		Not-Closed Circuited	Closed-Circuited	Not-Closed Circuited	Closed-Circuited	Not-Closed Circuited	Closed-Circuited	
Minor Athabasca River Tributaries ¹	159,240	9,694	23,113			9,694	23,113	32,807
Mills Creek	2,380		252				252	252
Shipyard Lake	4,046		3,751				3,751	3,751
Calumet	17,354	40	175			40	175	215
Christina	1,303,805	1,328	112	2,072	535	3,400	647	4,047
Ells	245,000	295	161			295	161	456
Firebag	568,174	967	436			967	436	1,404
Fort Creek	3,193	1,953	30			1,953	30	1,983
Hangingstone	106,641			17	47	17	47	64
Horse	215,741			321	104	321	104	426
MacKay	557,000	1,101	278			1,101	278	1,379
McLean	4,712	87	1,080			87	1,080	1,167
Muskeg	146,000	4,357	9,895			4,357	9,895	14,253
Original Poplar ²	13,856	127	299			127	299	427
Steepbank	135,491	2,518	961			2,518	961	3,479
Tar	33,261	826	6,395			826	6,395	7,220
Upper Beaver ²	28,711	773	1,935			773	1,935	2,708
FSA Total	3,544,606	24,068	48,873	2,410	687	26,478	49,560	76,038

Only land changes within the RAMP FSA were delineated.

¹ Refers to Athabasca River tributaries from Fort McMurray to the mouth of the Firebag River excluding the watersheds explicitly listed in this table. All land change areas in the minor Athabasca River tributaries in 2007 were above RAMP hydrology station S24.

² Original Poplar refers to the Poplar Creek watershed prior to the Beaver Creek diversion, while "Upper Beaver" refers to that part of the Beaver Creek drainage that now drains into Poplar Creek as a result of the Beaver Creek diversion. Drainage boundaries were estimated from maps provided in Syncrude Canada Ltd. (1977).

Table 2.4-2 Percent of total watershed areas with land change in 2008.

Watershed	Total Watershed Area (ha)	Percent of Watershed Area with Land Change						Watershed Total
		Focal Projects		Other Oil Sands Projects in RAMP FSA		Total		
		Not-Closed Circuited	Closed-Circuited	Not-Closed Circuited	Closed-Circuited	Not-Closed Circuited	Closed-Circuited	
Minor Athabasca River Tributaries ¹	159,240	6.09	14.51			6.09	14.51	20.60
Mills Creek	2,380		10.59				10.59	10.59
Shipyard Lake	4,046		92.71				92.71	92.71
Calumet	17,354	0.23				0.23	1.01	1.24
Christina	1,303,805	0.10	0.01	0.16	0.04	0.26	0.05	0.31
Ells	245,000	0.12	0.07			0.12	0.07	0.19
Firebag	568,174	0.17	0.08			0.17	0.08	0.25
Fort Creek	3,193	61.17	0.93			61.17	0.93	62.10
Hangingstone	106,641			0.02	0.04	0.02	0.04	0.06
Horse	215,741			0.15	0.05	0.15	0.05	0.20
MacKay	557,000	0.20	0.05			0.20	0.05	0.25
McLean	4,712	1.85	22.92			1.85	22.92	24.77
Muskeg	146,000	2.98	6.78			2.98	6.78	9.76
Original Poplar ²	13,856	0.92	2.16			0.92	2.16	3.08
Steepbank	135,491	1.86	0.71			1.86	0.71	2.57
Tar	33,261	2.48	19.23			2.48	19.23	21.71
Upper Beaver ²	28,711	2.69	6.74			2.69	6.74	9.43
FSA Total	3,544,606	0.68	1.38	0.07	0.02	0.75	1.40	2.15

Only land changes within the RAMP FSA were delineated.

¹ Refers to Athabasca River tributaries from Fort McMurray to the mouth of the Firebag River excluding the watersheds explicitly listed in this table. All land change areas in the minor Athabasca River tributaries in 2007 were above RAMP hydrology station S24.

² Original Poplar refers to the Poplar Creek watershed prior to the Beaver Creek diversion, while "Upper Beaver" refers to that part of the Beaver Creek drainage that now drains into Poplar Creek as a result of the Beaver Creek diversion. Drainage boundaries were estimated from maps provided in Syncrude Canada Ltd. (1977).