

## **2.0 ACTIVITIES IN THE RAMP FOCUS STUDY AREA IN 2007**

### **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 in 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 water withdrawals all have the potential to affect aquatic resources in receiving waters.

This section provides a synthesis of information related to development pressures that may be influencing aquatic environmental resources within the RAMP Focus Study Area (FSA), and describes relevant activities that occurred in 2007 in the focal projects (i.e., those projects within the RAMP FSA owned by 2007 RAMP funders which were under construction or operational in 2007, described below in Section 2.2).

Table 2.2-1 summarizes the current status of each of these projects as of the end of 2007. The date of initial environmental disturbance of each project has also been included where possible because this represents the first activity that has the potential to affect local aquatic systems (i.e., conservative approach).

In addition, a list of oil sands projects within the RAMP FSA that were under active development in 2007 by companies that were not funders of RAMP in 2007 is also provided (Section 2.3).

The information pertaining to all these types of projects was obtained from:

- Publications from the Energy Resources Conservation Board (ERCB), formerly the Alberta Energy and Utilities Board, on active oil sands schemes (EUB 2007);
- Field observations during RAMP monitoring surveys;
- Information provided by industry representatives of RAMP;
- An analysis of summer and fall 2007 satellite imagery for estimation of land changes in the RAMP FSA; and
- Information found on RAMP-member and other company websites.

## **2.2 FOCAL PROJECT ACTIVITIES IN 2007**

### **2.2.1 Suncor Energy Inc.**

Suncor's projects in the RAMP FSA in 2007 were Lease 86/17; the Steepbank Mine; the Millennium Mine; the Firebag Project; and associated expansions, upgraders, tailings ponds and other facilities. Its activities in 2007 included:

- Exploratory drilling;

**Table 2.2-1 Status and activities of developments owned by 2007 RAMP-funders in the RAMP Focus Study Area.**

2007 RAMP Funder	Development	Location		Type of Operation	Capacity <sup>1</sup>	Year of Application	Year of First Disturbance	2007 Status
		Oil Sands Leases	Township and Range					
<b>Suncor Energy Inc.</b>	Lease 86/17	Lease 86, Lease 17	23-92-10-W4M	mine	280,000	1964	1967	<b>No Mining</b>
	Steepbank Mine	Leases 97, 19, 25 and Fee Lots 1 and 3	91-9-W4M and 92-9-W4M	mine		1996	1997	<b>Operational</b>
	Millennium Mine	Leases 25, 19 and Fee Lots 3 and 4	91,92-9-W4M	mine		1998	2000	<b>Operational</b>
	Millennium Upgrader and Expansion	Lease 86, Lease 17, Lease 23	92-10-W4M		300,000	1998	2000	<b>Operational</b>
	South Tailings Pond	Lease 25, Lease 19	90,91-8-W4M, 91-9-W4M			2003	2005	<b>Construction</b>
	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	<b>Operational</b>
	Voyageur: North Steepbank Mine Extension	Lease 25, Lease 97, Fee Lot 1	92,93-9-W4M	mine	180,000	2005	--	<b>Approved</b>
	Voyageur: Voyageur Upgrader	Fee Lot 2, Lease 23	91,92-10-W4M		550,000 <sup>2</sup>	2005	--	<b>Approved</b>
<b>Syncrude Canada Ltd.</b>	Mildred Lake	Lease 17, Lease 22	6-93-10-W4M	mine	250,000	1973	1973	<b>Operational</b>
	Aurora North	Lease 10, Lease 12, Lease 34	96-9,10,11-W4M	mine	200,000	1996	1996	<b>Operational</b>
	Mildred Lake Upgrader and Expansion	Lease 17, Lease 22	6-93-10-W4M		350,000	1998	existing area	<b>Operational</b>
<b>Albian Sands Energy Inc.</b>	Muskeg River Mine	Lease 13	95-10-W4M	mine	155,000	1997	2000	<b>Operational</b>
	Muskeg River Mine Expansion	Lease 13, Lease 90	95-8,9-W4M, 94-10-W4M	mine	115,000	2005	2007	<b>Construction</b>
<b>Shell Canada Ltd.</b>	Jackpine Mine (Phase 1)	Lease 13	95-8-W4, 95-9-W4	mine	200,000	2002	2006	<b>Construction</b>
<b>CNRL</b>	Horizon	Lease 18	96-11/12-W4M, 96-13-W4M, 97-11-W4M, 97-12-W4M, 97-13-W4M	mine	270,000	2002	2004	<b>Construction</b>
<b>Imperial Oil Resources</b>	Kearl	Leases 6, 87, 36 31A, 88	95,96,97-R6-W4M, 95,96,97-R7-W4M, 95,96,97-R8-W4M	mine	300,000	2005	--	<b>Approved</b>
<b>Petro-Canada Oil and Gas</b>	Dover	7187060328	93-12-W4M	<i>in situ</i>	900	unknown	unknown	<b>Operational</b>
	Fort Hills	7598060T05, 7281020T52, 7400120008	96-11-W4M, 97,98-10-W4M	mine	190,000	2001	2005	<b>Construction</b>
	MacKay River	7282030T75	92, 93-12-W4M	<i>in situ</i>	33,000	1998	2000	<b>Operational</b>
	MacKay River Expansion	7282030T75, 728004AT22, 7187060328	92, 93-12-W4M	<i>in situ</i>	40,000	2006	--	<b>Application</b>
	Meadow Creek	7281010T58, 7283010T81	Townships 84, 85, Ranges 8, 9, 10-W4M	<i>in situ</i>	80,000	2001	--	<b>Approved</b>
<b>OPTI Canada Ltd. /Nexen Inc.</b>	Long Lake Pilot	Lease 27	85-6-W4M	<i>in situ</i>	3,000	unknown	2003	<b>Operational</b>
	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	<b>Construction</b>
	Long Lake Project (Phase 2)	Lease 27	84 6&7-W4M	<i>in situ</i>	70,000	2003	2004	<b>Approved</b>
<b>Total E&amp;P Joslyn Ltd.</b>	Joslyn, SAGD Phase I	7280060T24, 7404110452, 7405070799	94,95,96-11-W4M, 94-12-W4M	<i>in situ</i>	600	unknown	2003	<b>Under Closure</b>
	Joslyn, SAGD Phase II			<i>in situ</i>	10,000	2004	2005	<b>Operational</b>
	Joslyn, SAGD Phase III			<i>in situ</i>	15,000	2005	--	<b>Application</b>
	Joslyn North Mine Project			mine	100,000	2006	--	<b>Application</b>
<b>Husky Energy</b>	Sunrise	728704AT87, 728103AT49, 740101A022, 740012A006, 7401100015, 7002080057, 742080006	Townships 94-97, Ranges 6-7, W4M	<i>in situ</i>	200,000	2004	2007	<b>Construction</b>
<b>Synenco Energy Inc.</b>	Northern Lights	Lease 15, Lease 16, Lease 789	Townships 98 and 99, Ranges 5 to 7, W4M	mine	100,000	2006	--	<b>Application</b>
<b>Birch Mountain Resources Ltd.</b>	Muskeg Valley Quarry	MAIM Leases 9494070001, 9494070002, 9403120367, 9499030555, and 9400080004	94,95-10-W4M	quarry	limestone product, 7 million t/yr	2004	2005	<b>Operational</b>
	Hammerstone Quarry	MAIM Leases 9494070001, 9494070002, 9403120367, 9499030555, and 9400080004	94-10-W4M	quarry	limestone product, 18 million t/yr	2006	--	<b>Application</b>

Notes: Information in this table obtained from EUB (2007), ERCB project approvals, project EIA documents, and company websites.

<sup>1</sup> Unless otherwise stated, units are in bpd.

<sup>2</sup> Suncor's total planned upgrading capacity once Voyageur begins operations.

- Muskeg dewatering for the Millennium Mine, with approximately 5 million m<sup>3</sup> of water being dewatered and routed to ponds;
- Water discharge of approximately 0.073 million m<sup>3</sup> of water from the sedimentation pond at the Voyageur Upgrader site to Ruth Lake; and
- Withdrawal of approximately 43.6 million m<sup>3</sup> of water from the Athabasca River.

### **2.2.2 Syncrude Canada Ltd.**

Syncrude's active oil sands projects in the RAMP FSA in 2007 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 2007 included:

- Continued exploratory drilling;
- Withdrawal of 35.95 million m<sup>3</sup> from the Athabasca River; and
- Discharge of 0.261 million m<sup>3</sup> of treated domestic sewage to the Athabasca River.

#### ***Syncrude Aurora North Mine***

The Aurora North Mine is located north of the Albian 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 2007 included:

- Continued exploratory drilling;
- Alteration of the Muskeg watershed through the rerouting of Stanley Creek at NE 24-96-10-W4M and SE 19-96-09 W4M; and
- As part of the Aurora Clean Water Diversion system, there was a diversion of 1.99 million m<sup>3</sup> of water to Stanley Creek and the Muskeg River from muskeg dewatering activities as well as site drainage.

### **2.2.3 Albian Sands Energy Inc.**

Albian Sands operates the Muskeg River Mine which consists of an open-pit mine and extraction plant. In 2007, Albian 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 Albian Sands in 2007 in regards to the Muskeg River Mine included:

- Continued exploratory drilling;
- No instream work; however a new bridge was constructed over the Muskeg River on the Albian site and horizontal drilling for pipelines under the Muskeg River occurred twice in 2007 (25 m below the riverbed);

- 60 ha of land cleared and 87 ha of land disturbed;
- Dewatering of 342 ha of muskeg in the 3<sup>rd</sup> and 4<sup>th</sup> quarter of 2007, with water being collected in the External Tailings Facility; and
- Water withdrawal from the Athabasca River totaling 5.71 million m<sup>3</sup>.

In addition, construction on the Muskeg River Mine Expansion began in 2007.

#### **2.2.4 Shell Canada Limited**

Construction activities continued in 2007 on Shell's Jackpine Mine Phase 1 project; these activities included:

- Geotechnical drilling;
- Land clearing in the Muskeg River watershed with instream works in Shelley Creek;
- Muskeg dewatering during the ice-free season in 2007; and
- Release of water collected from site runoff and muskeg dewatering from settling ponds: 3.4 million m<sup>3</sup> of water discharged into Shelley Creek; 0.4 million m<sup>3</sup> of water discharged into Jackpine Creek; and 0.24 million m<sup>3</sup> of water discharged into Khahago Creek.

#### **2.2.5 Canadian Natural Resources Ltd.**

Construction activities continued in 2007 on the CNRL Horizon project on Lease 18; these activities included:

- Continued exploratory drilling and land clearing;
- In-stream works in all months of 2007 except March, June, August, and December in the Tar River watershed;
- Alteration of the main channel drainage pattern in the Tar River in October 2007;
- Water withdrawal of 7.03 million m<sup>3</sup> from the Athabasca River in 2007; and
- Water discharge from the wastewater treatment plant to the Athabasca River via the Tar River throughout 2007 of 0.38 million m<sup>3</sup> between January and December 2007.

#### **2.2.6 Petro-Canada Oil and Gas**

Petro-Canada's active projects in the RAMP FSA in 2007 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 2007 included:

- Ongoing exploratory drilling and land clearing;
- Land clearing and project construction in Stanley Creek, Fort Creek and McClelland Lake watersheds. Instream work took place during April, May, and October in Fort Creek;

- Dewatering activities from March to December. Approximately 0.5 million m<sup>3</sup> of water was dewatered and discharged from settling ponds to Fort Creek;
- Alteration of drainage patterns of two unnamed creeks in the Fort Creek watershed; and
- Withdrawal of 58,000m<sup>3</sup> of water from the Athabasca River.

### ***Petro-Canada MacKay River***

Specific activities conducted by Petro-Canada in 2007 in regards to the MacKay River Project included:

- Land clearing and project construction in the MacKay River watershed;
- Stormwater discharge of 2000 m<sup>3</sup> over the year; and
- Withdrawal of groundwater from the Birch Channel.

## **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. The Long Lake Pilot Project continued operation in 2007, while construction of Phase 1 of the Long Lake Project (*in situ* plus upgrader) continued throughout 2007. Groundwater withdrawals for operations totalled approximately 0.69 million m<sup>3</sup> in 2007.

## **2.2.8 Total E & P Joslyn Ltd.**

Total E & P Joslyn Ltd.'s active projects in the RAMP FSA in 2007 were the *in situ* Joslyn Phase I and Phase II Projects on Lease 24. The Joslyn Phase I project is being dismantled, while production from the Joslyn Phase II project continued throughout 2007; groundwater withdrawals for the Phase II project were approximately 0.11 million m<sup>3</sup> in 2007.

## **2.2.9 Birch Mountain Resources Ltd.**

Birch Mountain Resources Ltd. continued operation of its Muskeg Valley Quarry in 2007. Approximately 0.03 million m<sup>3</sup> of water was discharged in 2007 from quarry pits to a defined wetland approximately 1 km from the Muskeg River.

## **2.2.10 Husky Energy Inc.**

Husky Energy Inc. began construction of the Sunrise Thermal Project in 2007; activities included: exploratory drilling; land clearing and project construction occurred the Wapasu Creek drainage; and alteration of the drainage pattern of an unnamed tributary to Wapasu Creek.

## **2.2.11 Imperial Oil Resources**

Imperial Oil's activities undertaken during 2007 in support of its Kearl Project included shallow test pits for gravel; seismic lines for geotechnical investigations; and the creation of ground water wells.

## 2.3 NON-RAMP MEMBER OIL SANDS PROJECTS

There were eight approved oil sands development projects active in the RAMP study area in 2007 and whose operators were not members of RAMP in 2007. 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 2007.**

Operator	Effective Date	Field or Area	Location (Township and Range)	Recovery Method
EnCana	3 Apr 2000	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	7 Mar 2006	Hangingstone	NW26, N27, N28, 33, 34, W35-84-11W4M	SAGD
ConocoPhillips	15 May 2003	Athabasca	81-6W4M, 1, 2, 11 to 14, 23 to 29, 32 to 36-81-7W4M, NW 82-5W4M, 82-6W4M, 82-7W4M, SW 83-5W4M, 83-6W4M, 83-7W4M	SAGD
ConocoPhillips	25 May 2006	Surmont	24-83-7W4M	Steam Stimulation
Devon	18 Nov 2004	Jackfish	19 to 21, 28 to 33-75-6W4M, 4 to 6-76-6W4M	SAGD
MEG Energy	25 Jan 2006	Christina Lake	7 to 9, 16 to 18, N19 to N21-77-5W4, E12, E13, E24-77-6W4	SAGD
Whitesands	20 Feb 2004	Whitesands	12, 13-77-9W4M	Toe to Heel Air Injection
Connacher	31 Jul 2006	Great Divide	NW16, NE17, SE20, 21-82-12W4	SAGD

From EUB (2007)

## 2.4 LAND CHANGE EFFECTS OF DEVELOPMENT ACTIVITIES IN 2007

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 changed for a number of land change classes in each of the main RAMP FSA watersheds in 2007.

A set of 4 SPOT-5 10m resolution images taken on the 20, 23, and 30 July 2007 were obtained as well as a 30m resolution Landsat-5 image taken on September 9, 2007. A land change classification protocol was developed and applied to the imagery to identify and delineate two types of land change in 2007 from the projects listed in Table 2.2-1 and in Table 2.3-1: land change area that is not closed-circuited; and land change area that is 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 2007 land change maps.

Land change area as of 2007 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 July 2007, north of Fort McMurray.

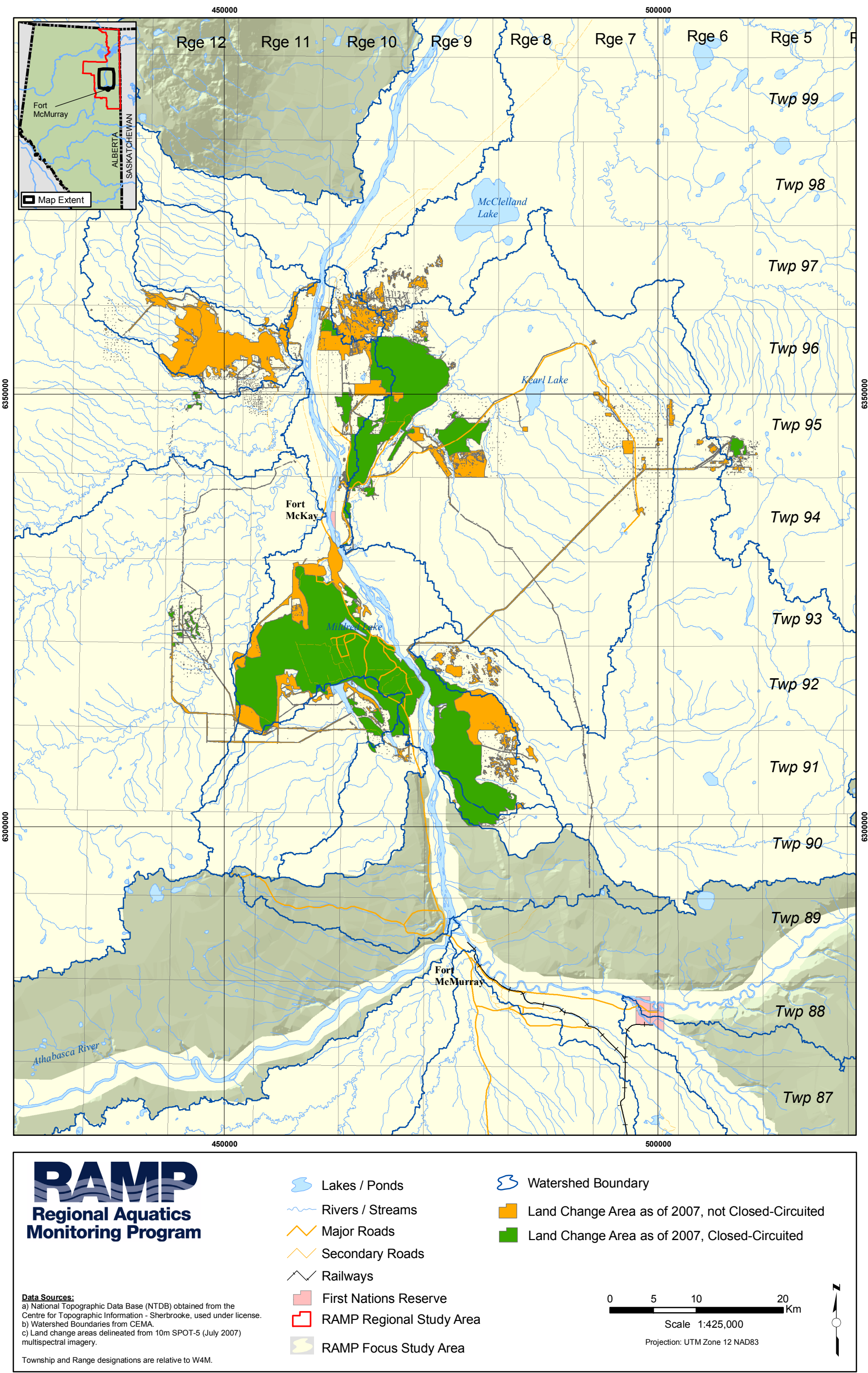






Figure 2.4-2 RAMP land change classes derived from SPOT-5 satellite imagery of July 2007 and Landsat-5 of September 2007, south of Fort McMurray.

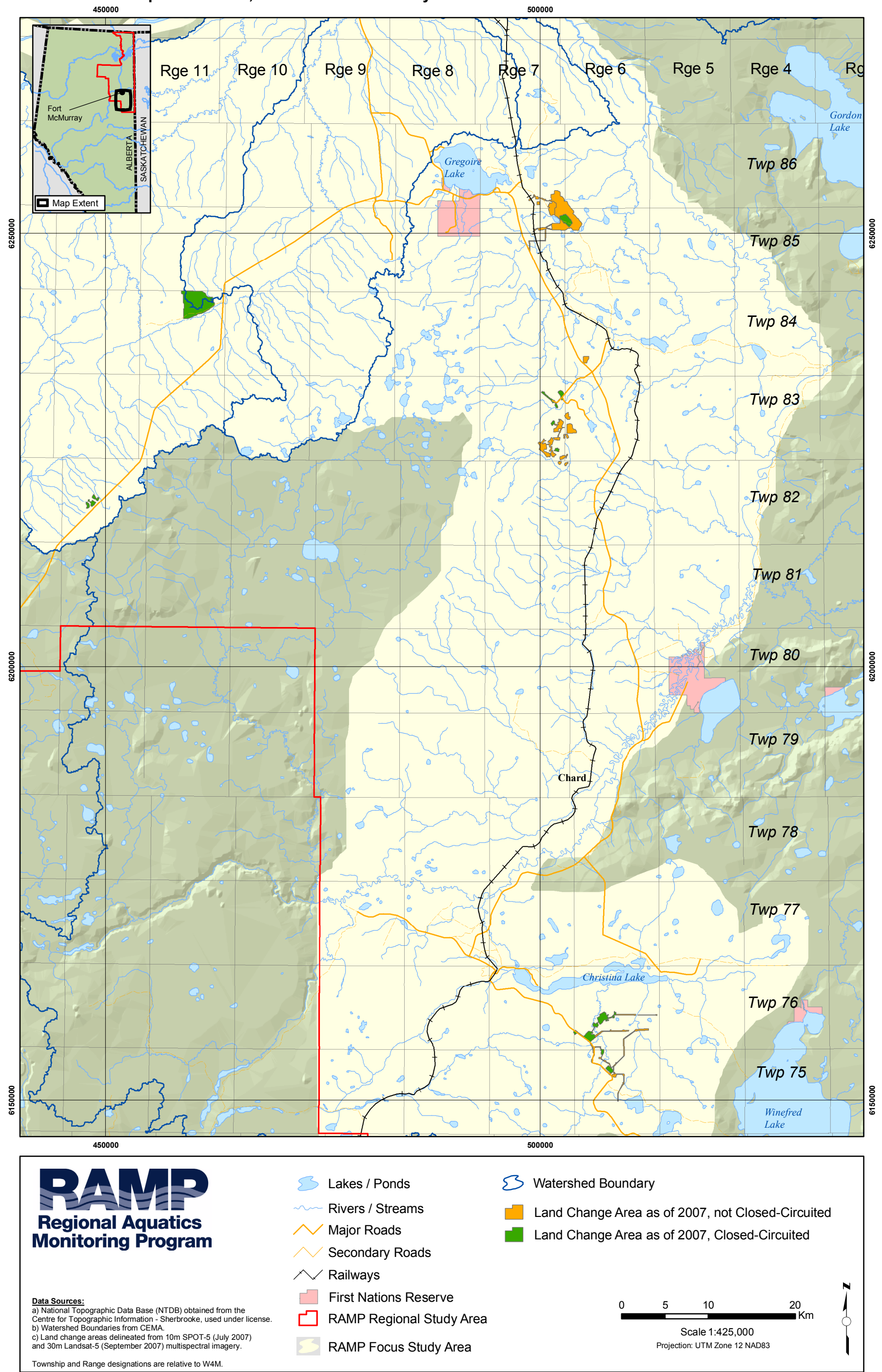




Table 2.4-1 and Table 2.4-2 provide tabular summaries of the land changes in each of the main watersheds by each land change type, for focal projects and non-RAMP oil sands projects within the RAMP FSA. Land change as of 2007 within the RAMP FSA is estimated at approximately 64,000 ha for focal projects and slightly more than 2,200 ha for oil sands projects operated by non-RAMP funding companies, for a total of slightly more than 66,000 ha, or approximately 1.9% of the area of the RAMP FSA. The percentage of the area of watersheds with land change as of 2007 varies from less than 1% for many watersheds (MacKay, Ells, Christina, and Firebag), to 5% to 10% for the Muskeg watershed, to more than 10% for the Fort Creek, Tar, and McLean watersheds, as well as the smaller Athabasca River tributaries from Fort McMurray to the mouth of the Firebag River.

**Table 2.4-1 Area of watersheds with land change in 2007.**

Watershed	Total Watershed Area (ha)	Watershed Area with Land Change (ha)						
		Focal Projects		Other Oil Sands Projects in RAMP FSA		Total		Watershed Total
		Not Closed-Circuited	Closed-Circuited	Not Closed-Circuited	Closed-Circuited	Not Closed-Circuited	Closed-Circuited	
Minor Athabasca River Tributaries <sup>1</sup>	165,666	8,963	25,516			8,963	25,516	34,479
Calumet	17,354	217				217		217
Christina	1,303,805	1,001	114	824	449	1,825	563	2,388
Ells	245,000	146	87			146	87	233
Firebag	568,174	982	270			982	270	1,252
Fort Creek	3,193	1,626	40			1,626	40	1,666
Hangingstone	106,641				386		386	386
Horse	215,741				545		545	545
MacKay	557,000	839	264			839	264	1,103
McLean	4,712	48	1,076			48	1,076	1,124
Muskeg	146,000	3,659	9,378			3,659	9,378	13,037
Original Poplar <sup>2</sup>	13,856	121	260			121	260	381
Steepbank	135,491	1,538	186			1,538	186	1,724
Tar	33,261	7,036				7,036		7,036
Upper Beaver <sup>2</sup>	28,711	804				804		804
FSA Total	3,544,606	26,980	37,191	824	1,380	27,804	38,571	66,375

Only land changes within the RAMP FSA were delineated.

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

<sup>2</sup> 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 2007.**

Watershed	Total Watershed Area (ha)	Watershed Area with Land Change (ha)						
		Focal Projects		Other Oil Sands Projects in RAMP FSA		Total		Watershed Total
		Not Closed-Circuited	Closed-Circuited	Not Closed-Circuited	Closed-Circuited	Not Closed-Circuited	Closed-Circuited	
Minor Athabasca River Tributaries <sup>1</sup>	165,666	5.41	15.40	-	-	5.41	15.40	20.81
Calumet	17,354	1.25	-	-	-	1.25	-	1.25
Christina	1,303,805	0.08	0.01	0.06	0.03	0.14	0.04	0.18
Ells	245,000	0.06	0.04	-	-	0.06	0.04	0.10
Firebag	568,174	0.17	0.05	-	-	0.17	0.05	0.22
Fort Creek	3,193	50.92	1.25	-	-	50.92	1.25	52.18
Hangingstone	106,641	-	-	-	0.36	-	0.36	0.36
Horse	215,741	-	-	-	0.25	-	0.25	0.25
MacKay	557,000	0.15	0.05	-	-	0.15	0.05	0.20
McLean	4,712	1.02	22.84	-	-	1.02	22.84	23.85
Muskeg	146,000	2.51	6.42	-	-	2.51	6.42	8.93
Original Poplar <sup>2</sup>	13,856	0.87	1.88	-	-	0.87	1.88	2.75
Steepbank	135,491	1.14	0.14	-	-	1.14	0.14	1.27
Tar	33,261	21.15	-	-	-	21.15	-	21.15
Upper Beaver <sup>2</sup>	28,711	2.80	-	-	-	2.80	-	2.80
FSA Total	3,544,606	0.76	1.05	0.02	0.04	0.78	1.09	1.87

Only land changes within the RAMP FSA were delineated.

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

<sup>2</sup> 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).