Annexe 2.5

Assessment of the Impact of Baie-des-Sables Wind Farm on the Local Radio and TV Systems (Renewable Energy Systems, 2004)

COMMERCIAL IN CONFIDENCE

Assessment of the Impact of Baie des Sables Wind Farm on the Local Radio and TV Systems

Report No: 01491R00006

Issue No: 02

Date: 5 October 2004

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CONTENTS

1.0 INTRODUCTION

This report has been prepared by Renewable Energy Systems TEC Limited at the request of Cartier Wind Energy Inc.

Baie des Sables wind farm site is located to the east of Baie des Sables and Les Boules villages at 20Km to the south-west of Matane in the Peninsula of Gaspesie, Quebec. This report investigates the possibility that the proposed wind farm may cause interference to local radio and TV reception.

Most of the Peninsula of Gaspesie is sparsely populated, with most of its inhabitants located along the coast. The closest villages to the site are Metis sur Mer, Les Boules and Baie des Sables, west of the site, Desrosiers and Tartigou to the north, St Ulric de Matane and Riviere Blanche to the north-east and Saint Damase south of the site. Matane at 19Km north-east of the easternmost turbines and Mont-Joli at 17Km south-west of the westernmost turbines are the closest towns to the wind farm. Figure 1 shows a map of the Peninsula with the location of the proposed wind farm marked in red.

Figure 1: Map showing the Peninsula of Gaspesie with the area around the wind farm marked in red.

The "Broadcasting database and other related information" database of the Industry Canada [6] contains all the FM, AM and TV transmitter details of Canada. It is the main source of information this report is based on. The database has been searched and all those transmitters identified to be covering the area around the wind farm have been selected and studied.

Four FM radio stations will be considered in this report. Three of them, CBRX-FM-1, CHOE-FM and CHRM-FM are located around Matane (Petit-Matane), east of the site. The other one, CKMN-FM is located in Rimouski (St-Donat), south-west of the site.

Only one AM radio station, CBGA located in Matane will be considered in this report.

Five analogue TV stations will be considered in this report. Three of them, CFER-TV, CIVB-TV and CJBR-TV are located in Rimouski, more than 20Km south-west of the site (CFER-TV and CIVB-TV in St-Donat and CJBR-TV in St-Fabien). CHAU-TV-1 is located in Ste-Marguerite-Marie, 55Km south-east of the site. CBGAT is located in Petit-Matane (Matane), north-east of the site.

An image showing all the stations considered in this report (AM stations in red, FM stations in green and TV stations in blue), the wind farm site (with the Baie des Sables turbines coloured in blue), the development boundary (black line), surrounding area, nearest villages and buildings (coloured in black) and the HWY132 road (blue line along the coast) is given in figure 2a. Figure 2b is a detailed map of the area studied in this report (marked in figure 2a with a black rectangle). This area has been defined based on engineering experience to include the wind farm and at least 5Km around it. Not all buildings are believed to be inhabited. However the worst scenario is considered by including all of them in the analysis. All buildings have been obtained from the 1:20,000 Canadian map series.

It is possible for wind turbines to cause interference to local TV reception either by obstruction or by reflection. Viewers situated forward of a wind farm (so that their TV aerials are pointing through the turbines) may have their signals periodically obstructed by the rotating blades causing a ‘scattering’ of the signal. Viewers situated to the side may experience periodic reflections from the blades, giving rise to a delayed image or ‘ghost’.

In practice, RES have only experienced problems when the receiver already has a poor signal. Specifically, if the wind farm is illuminated by the transmitter, problems can occur when the receiver has no line of sight to the transmitter, but has a clear line of sight to the wind farm.

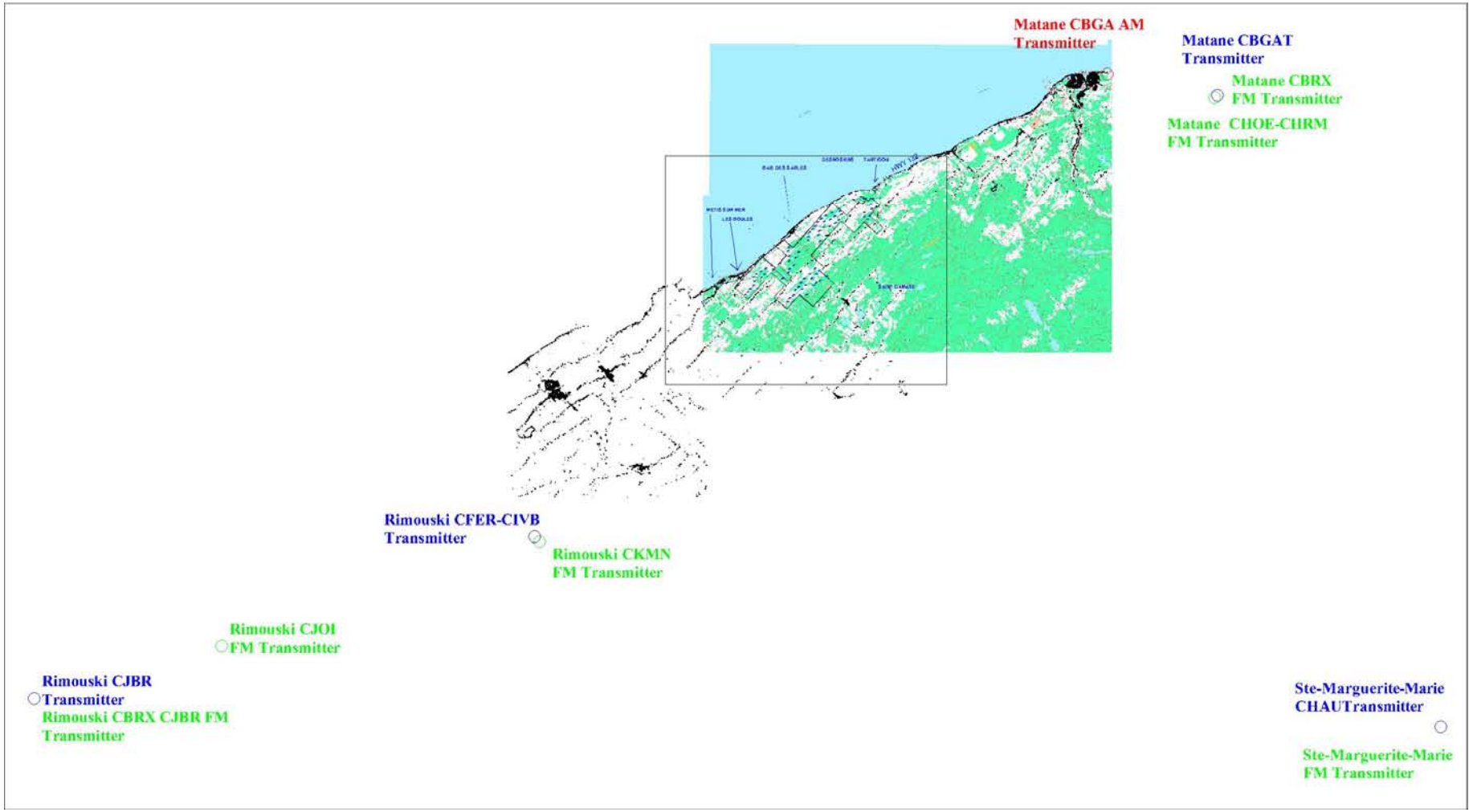

Figure 2a: Map showing wind farm (blue dots), development boundary (black line), buildings around the site (black dots), nearest villages, HWY132 road (blue line along the coast) and stations (AM in red, FM in green and TV in blue).

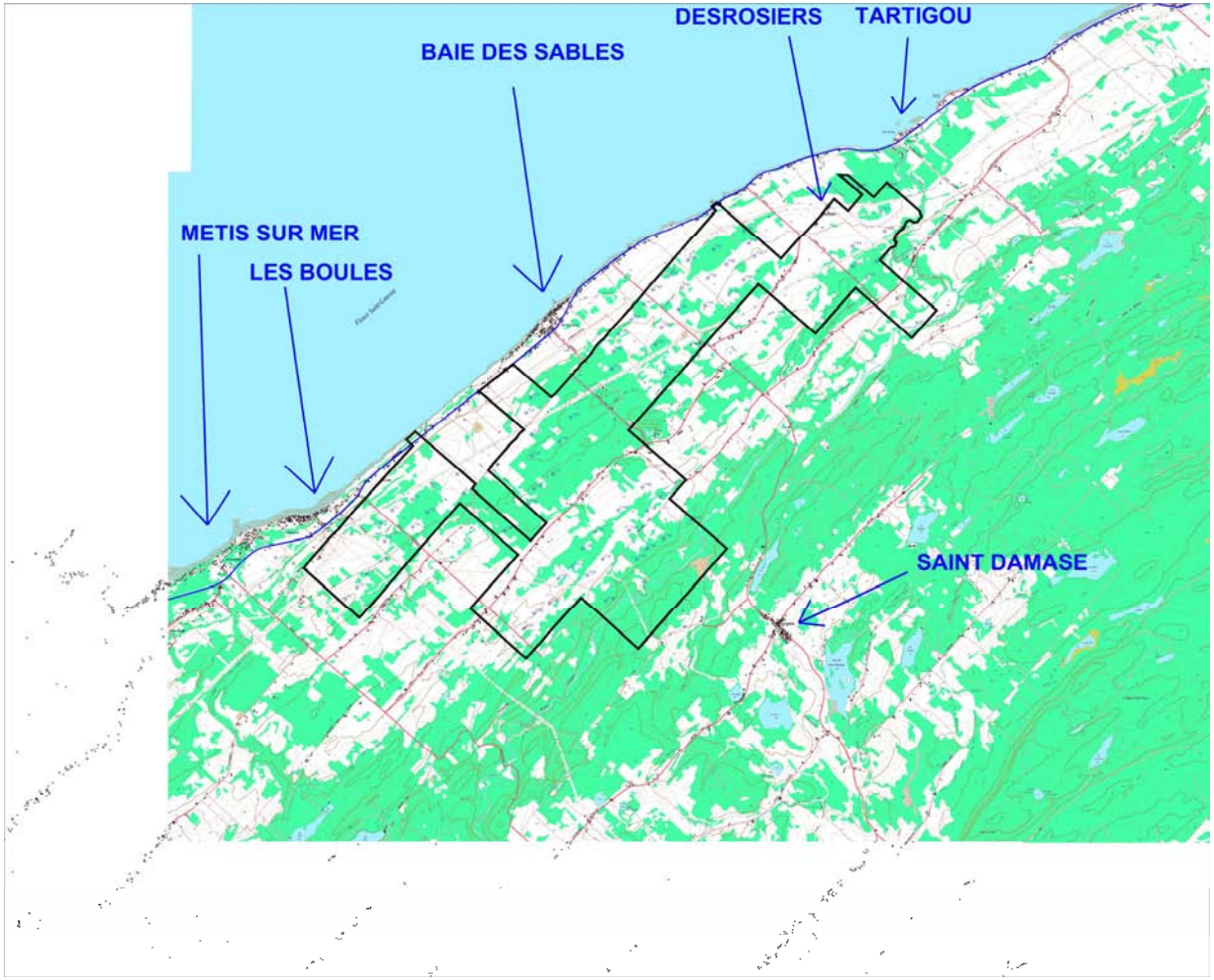

Figure 2b: Map showing wind farm (blue dots), development boundary (black line), buildings around the site (black dots), nearest villages and HWY132 road (blue line along the coast).

2.0 METHODOLOGY

2.1 Amplitude Modulated (AM) Systems

According to [7]:

"*AM broadcast signal reception is susceptible to interference from various man-made and natural sources of background noise. Due to the fact that a rotating wind turbine blade predominantly modulates the amplitude of an electromagnetic signal in its vicinity, interference with AM radio reception can be anticipated. However, since AM broadcast frequencies are low and signal wave lengths are very long, any interference will be confined to the immediate vicinity of a wind turbine."*

This assertion, supported by experience from other wind farms, brings us to consider only buildings that are in the immediate vicinity of a wind turbine as susceptible to interference to AM reception.

2.2 Frequency Modulated (FM) Systems

Results from laboratory simulation techniques [7] show that:

"*… the effects of wind turbine interference on FM radio reception are negligible, except possibly within a few tens of meters of a wind turbine located in a region of low signal-to-noise ratio for a particular FM station*".

This assertion, supported by experience from other wind farms, brings us to consider only buildings that are in the immediate vicinity of a wind turbine as susceptible to interference to FM reception.

2.3 Television Systems

This investigation uses ITU recommendations to assess the potential TV interference caused by the wind farm. The ITU (International Telecommunication Union) is the body that provides recommendations and guidelines to regulate and protect telecommunications. ITU Recommendation 805 [1] is used to model the TV interference caused by a single turbine. This is applied in conjunction with ITU Recommendation 526 [2] that describes a knife-edge diffraction model to account for attenuation of the TV signals by the intervening terrain ("Signal"). Multiple turbines are accounted for by applying these models between every turbine and receiver. The resultant field strength of the interfering signals reflected from each turbine is then calculated by adding all the signals together in phase ("Noise"). This is a conservative assumption as it would be realistic to assume that the reflected signals would not all be in phase at the receiver. Some evidence to suggest that the signals do not all add constructively is shown in experiments by the BBC [3].

The RES interference program uses the method described above in conjunction with terrain height data to predict a distribution of "Signal-to-Noise Ratio" (SNR) in the area surrounding the wind farm. The program has been tested on existing wind farms where TV interference has been experienced. In order to set the level at which the predicted SNR corresponds to unacceptable TV interference, the model has been applied to existing wind farms where TV

interference has actually occurred. One example is Lendrums Bridge wind farm in Northern Ireland. The results of the model are shown in figure 3. The two red circles are where TV interference has actually occurred. It can be seen from the figure that the points correspond to a SNR of below 10 dB. Such a low threshold can be explained by two terms in the model, about which little is known. The first is the reflectivity of a wind turbine, which depends on the precise shape, structure, and material of the rotor. Currently there is little information on this parameter and so it is set to a conservative level in the model. The second area of uncertainty is how to combine the individual interfering signals from each turbine. The assumption is made that the unwanted signals from all turbines add in phase at the receiver.

Based on existing evidence and third party measurements, the threshold of SNR below which TV interference is unacceptable is set to 10 dB. This assumption is supported by the measurements described in references [4] and [5] where TV interference occurred only when the highest secondary signal was within 10dB of the primary signal. Application of the model to existing wind farms (Lendrums, Elliot's Hill and Malhadas), where TV interference has occurred, also supports this assumption [5].

In March 2003 RES commissioned NTL to measure the interference experienced at locations around Lendrums Bridge wind farm [4]. The measurements were taken with the wind farm operating and with the wind farm shut down. This was done in order to quantify the interfering reflections from the rotor. The main objective of the work was to collect a real data set in order to validate the RES TV interference model. The results from this test verify that the model is a good predictor of TV interference [5].

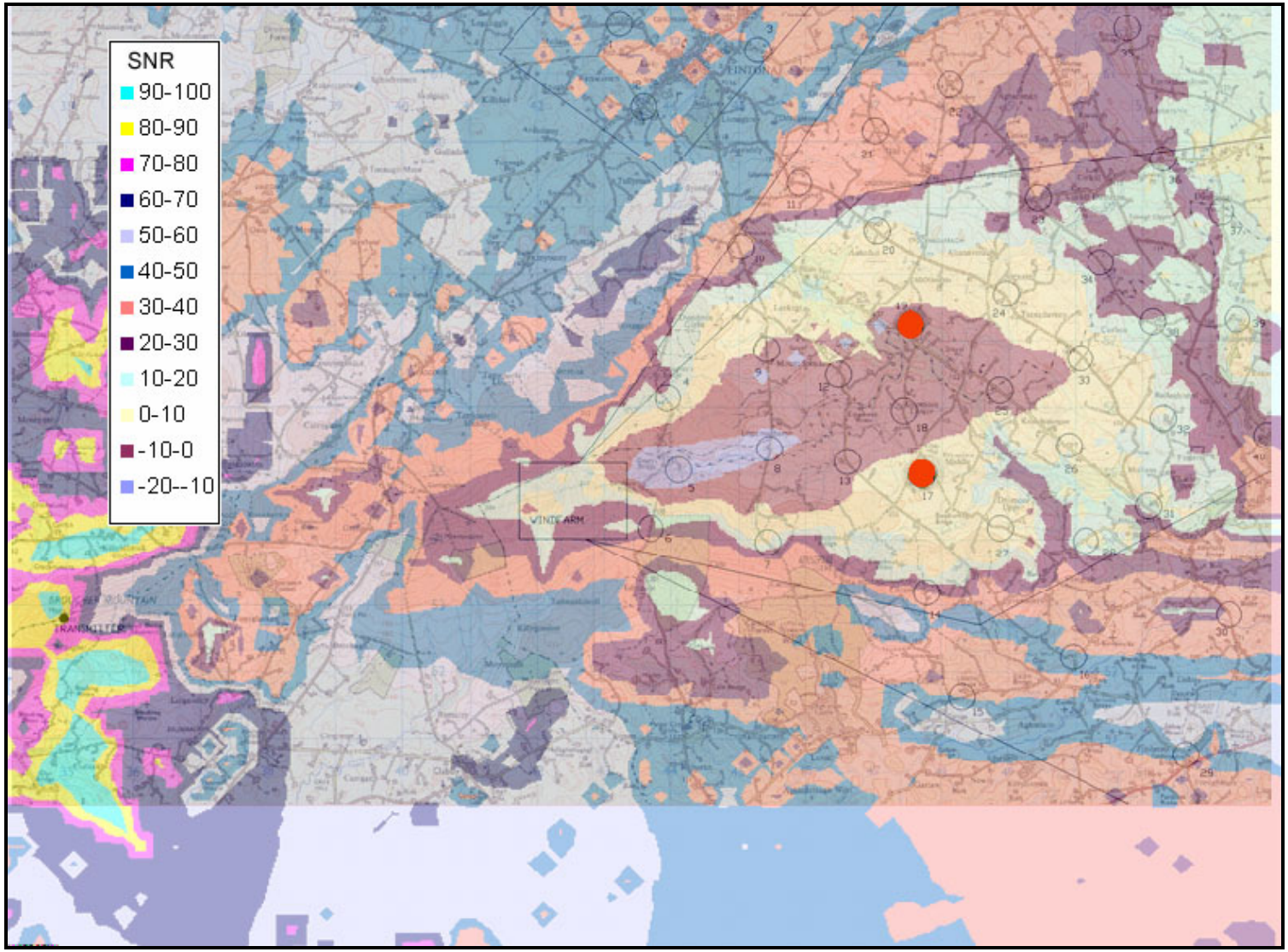

Figure 3: Predicted Interference at Lendrums Bridge.

3.0 RADIO SYSTEMS (AM, FM)

3.1 Amplitude Modulated (AM) Systems

Table 1 shows the details of the considered AM radio stations in the area [6].

Station ID (Village)	Latitude (ddmmss)	Longitude (ddmmss)	Channel	Frequency (KHz)
Matane CBGA	485103	673001	1250	1250

Table1: Details of AM Stations in the Wind Farm Area.

Due to the existing distances between turbines and buildings no interference to AM radio systems is expected.

3.2 Frequency modulated (FM) Systems

Table 2 shows the details of the considered FM radio stations in the area [6].

Station ID (Village)	Latitude (ddmmss)	Longitude (ddmmss)	Channel	Frequency (MHz)
Matane CBRX-FM-1 (Petit-Matane)	485000	672142	298	107.50
Matane CHOE-FM (Petit-Matane)	484954	672153	237	95.30
Matane CHRM-FM (Petit-Matane)	484954	672153	287	105.30
Rimouski CKMN-FM (St-Donat)	482748	681231	243	96.50

Table2: Details of FM Stations in the Wind Farm Area.

Due to the distance between buildings and turbines no interference is expected on FM radio systems.

4.0 TELEVISION SYSTEMS

4.1 Coverage Predictions

This section gives coverage predictions for each transmitter. These enable us to predict the current quality of the signal from each transmitter around the wind farm. Transmitter details are shown in table 3.

Station ID (Village)	Latitude (ddmmss)	Longitude (ddmmss)	ERP Power (KW)	Aerial Height (m agl)	Channel	Frequency (MHz)
Ste Marguerite Marie CHAU-TV-1 (Ste-Marguerite-Marie)	481840	670506	11.2	45.7	3	60.00
Matane CBGAT (Petit-Matane)	485000	672142	7.31	83.2	6	82.00
Rimouski CFER-TV (St-Donat)	482802	681253	325	88.1	11	198.00
Rimouski CIVB-TV (St-Donat)	482802	681253	1674.9	88.1	22	518.00
Rimouski CJBR-TV (St-Fabien)	481940	685009	100	62.4	2	54.00

Table 3: Details of TV Transmitters in the Wind Farm Area.

The predictions are given in the following sections. A signal of 46dBµV/m is regarded as the minimum level required for an acceptable quality of service for the CHAU-TV-1, CBGAT and CJBR-TV transmitters. A signal of 49dBµV/m is regarded as the minimum level required for an acceptable quality of service for the CFER-TV transmitter. A signal of 58dBµV/m is regarded as the minimum level required for an acceptable quality of service for the CIVB-TV transmitter. In the coverage images, areas in yellow and red are predicted to be receiving a low TV coverage whereas all other areas are predicted to be receiving a good or acceptable TV signal.

According to [6] the CHAU-TV-1, CBGAT and CFER-TV transmitters emit directionally towards the populations nearby them. The predicted coverage, however, has been made assuming that all transmitters use omnidirectional antennas to emit their signal. This fact does not affect the validity of this analysis as only those areas believed to be covered by a transmitter are analysed for interference.

4.1.1 Ste-Marguerite-Marie Transmitter Coverage

Predicted coverage for the CHAU-TV-1 station is shown in figure 4 (run CANbdsInt001). The coverage is good in general with a few patches receiving a poorer signal (lower than 45 dBµV/m).

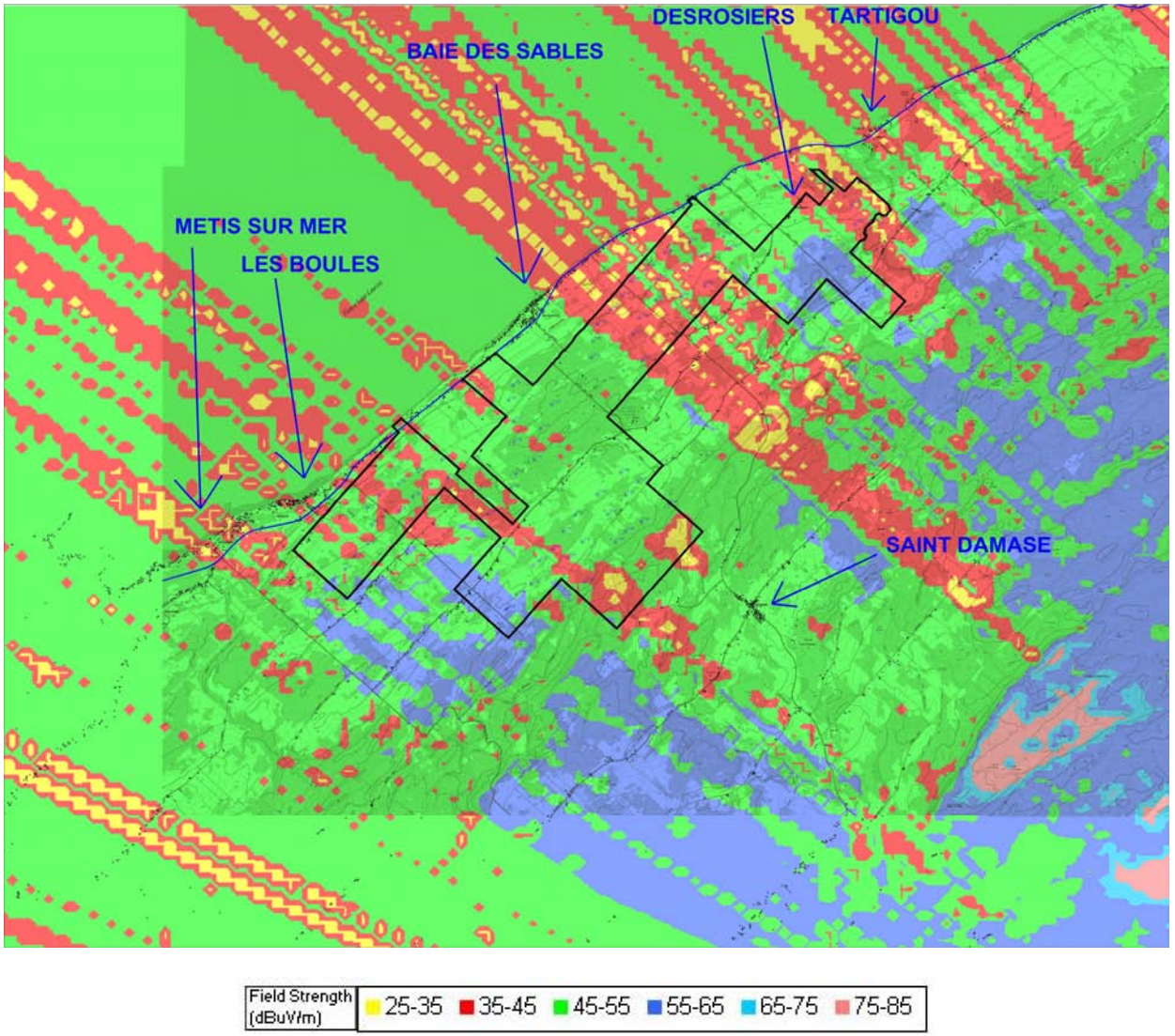

Figure 4: CHAU-TV-1 coverage (St-Marguerite-Marie transmitter).

4.1.2 Matane Transmitter Coverage

Predicted coverage for the CBGAT station is shown in figure 5 (run CANbdsInt003). The coverage is very good everywhere.

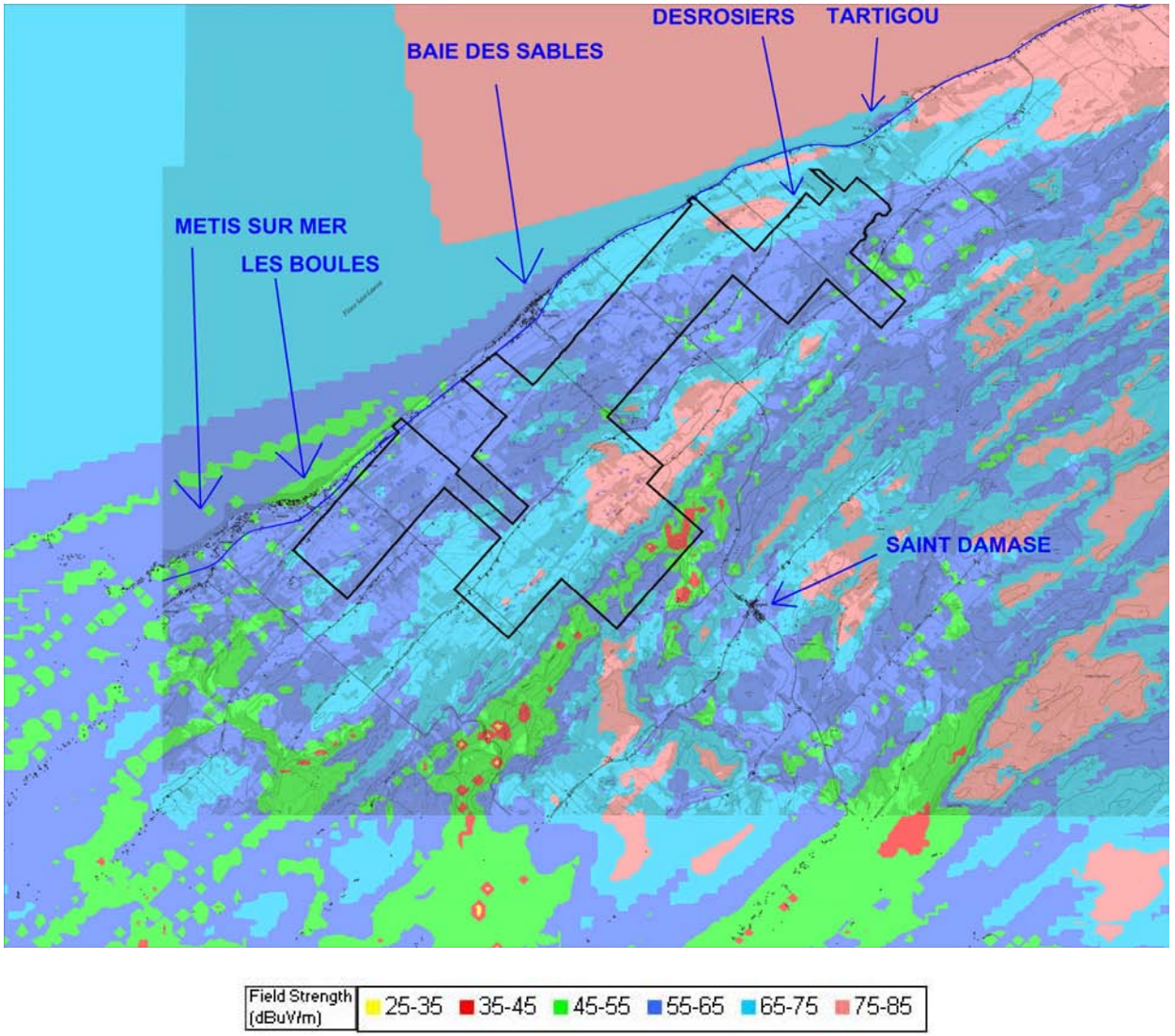

Figure 5: CBGAT coverage (Matane transmitter).

4.1.3 Rimouski Transmitters Coverage

Predicted coverage for the CBFER-TV, CIVB-TV and CJBR-TV stations are shown in figure 5 (run CANbdsInt004), figure 6 (run CANbdsInt005) and figure 7 (run CANbdsInt007). The coverage for these three stations is excellent everywhere as it is at least 20dBµV/m higher than the minimum strength required for acceptable reception in all this area.

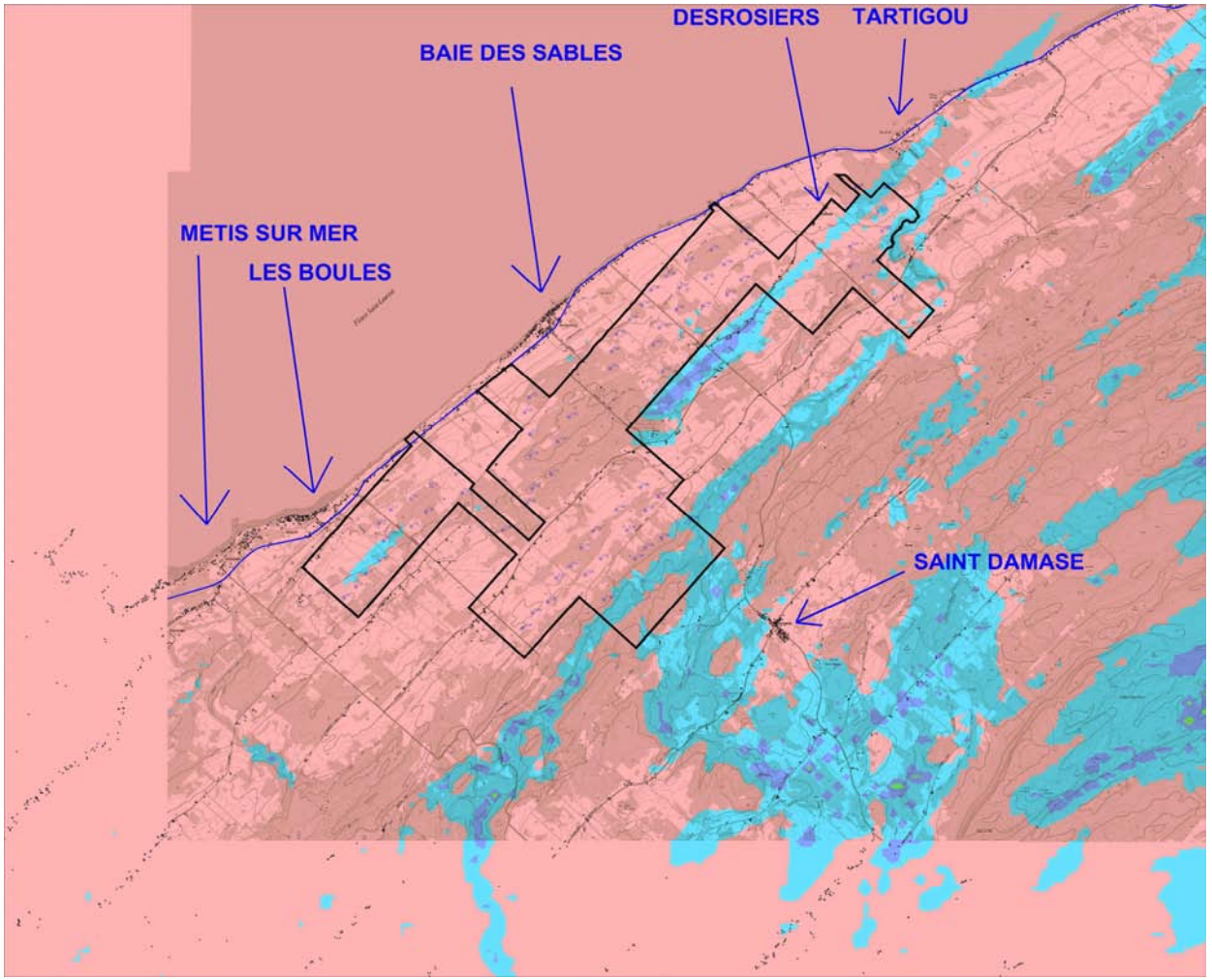

Figure 6: CFER-TV coverage (Rimouski transmitter).

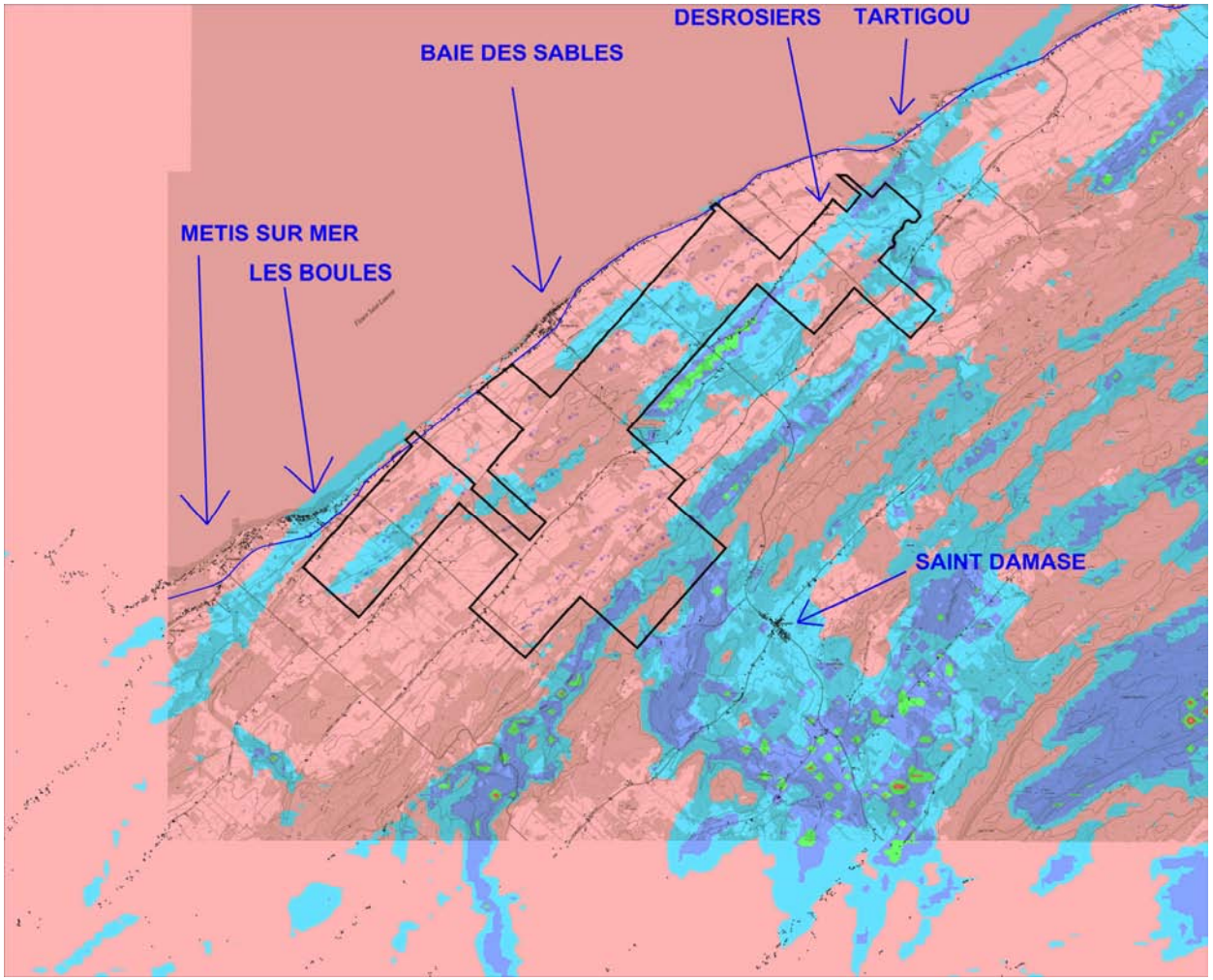

Figure 7: CIVB-TV coverage (Rimouski transmitter).

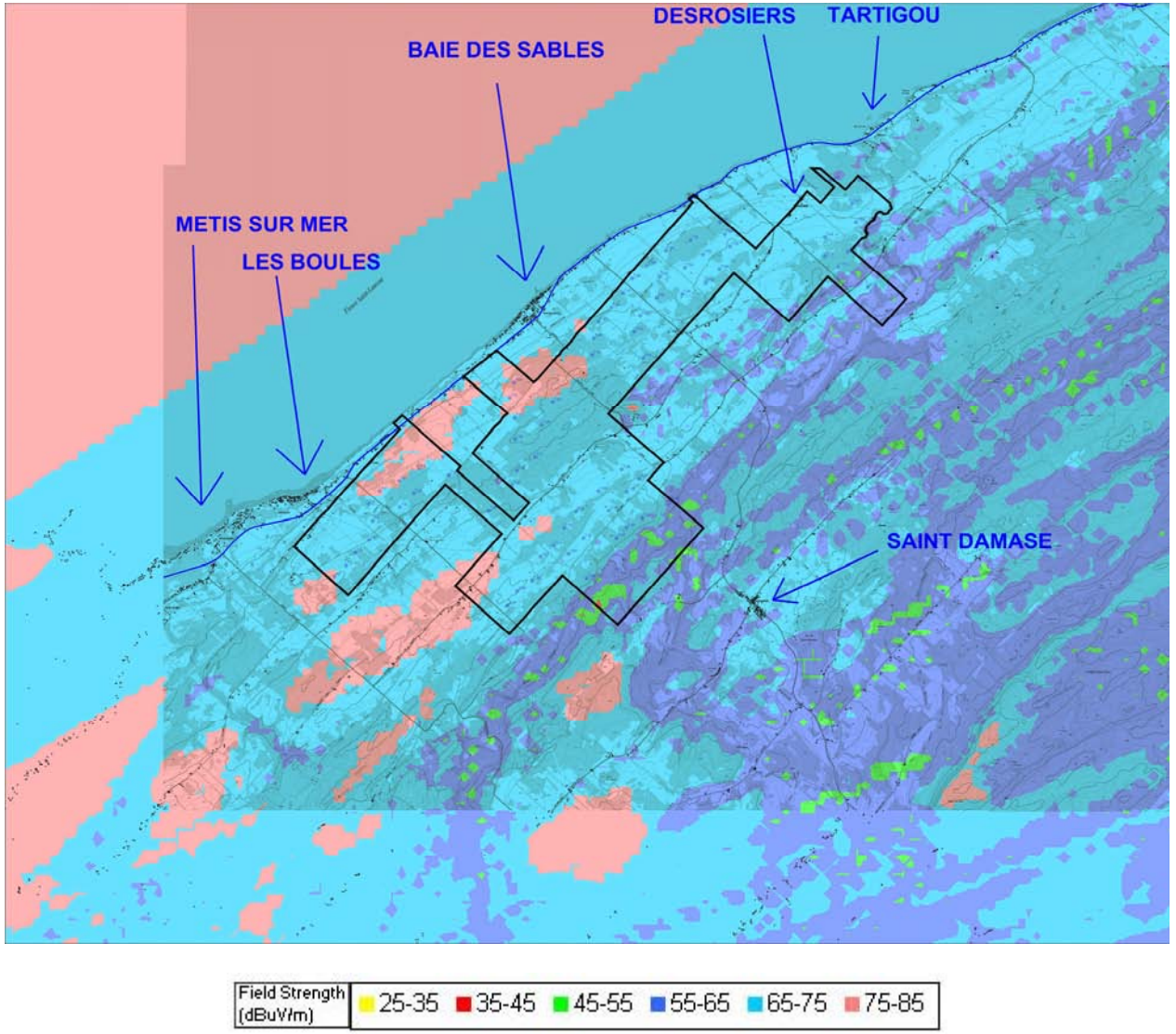

Figure 8: CJBR-TV coverage (Rimouski transmitter).

4.1.4 Summary of Coverage Predictions

The five stations considered in this assessment cover the whole studied area. The coverage from the Ste-Marguerite-Marie station is good in general with only a few patches of poorer signal. The coverage from the station at Matane is good in all the area. The three stations at Rimouski produce an excellent coverage everywhere.

4.2 Wind Farm Interference Predictions

In this section the results from the RES TV interference model are given. The model predicts signal to noise ratios (SNR) at locations around the wind farm. In this context the signal is the direct signal from the transmitter and the noise is the indirect, unwanted signal reflected by the wind farm. In all the interference images, areas in yellow and red may experience interference to TV reception whereas all other areas are not predicted to experience it.

The Baie des Sables turbine layout used in this study consists of 73 GE 1.5MW machines (layout PCANbds010). Each machine will have hub height of 80 m, and a three bladed rotor 77 m in diameter. This gives a maximum tip height of 118.5 m for each structure. The coordinates of the turbines used in this investigation are given in Table 4 below.

Turbine ID	X (m)	Y (m)	Turbine ID	X (m)	Y (m)
T1	271360	5392235	T38	276984	5392197
T2	271617	5392480	T39	277649	5393089
T3	271826	5392762	T40	277874	5393319
T4	272126	5393043	T41	278229	5393524
T5	272213	5393469	T42	278842	5393913
T6	272122	5393834	T43	277115	5397176
T7	272370	5394133	T44	277139	5397540
T8	272806	5394369	T45	277253	5397907
T9	273243	5394622	T46	277535	5398230
T10	273774	5394893	T47	277798	5398534
T11	272814	5393772	T48	278000	5398863
T12	273132	5394097	T49	278335	5399165
T13	273904	5394497	T50	278753	5399494
T14	274796	5393697	T51	279303	5399727
T15	275324	5394267	T52	279957	5400138
T16	275426	5394588	T53	280062	5399857
T17	275837	5394905	T54	280183	5399583
T18	275386	5395299	T55	279580	5399412
T19	275980	5395600	T56	279178	5399120
T20	275382	5395765	T57	278614	5398902
T21	275269	5396229	T58	279950	5399085
T22	275363	5396552	T59	279642	5398757
T23	276228	5396133	T60	279118	5398519
T24	275221	5391590	T61	278547	5398447
T25	275432	5391910	T62	278179	5398052
T26	275771	5392158	T63	278049	5397686
T27	275956	5392663	T64	278244	5397111

T28	276243	5392911
T29	276579	5392733
T30	276481	5393314
T31	276913	5393088
T32	276754	5393677
T33	277480	5393695
T34	277247	5394141
T35	277881	5394122
T36	277767	5394613
T37	278152	5394422

T65	282405	5401056
T66	283079	5401084
T67	282910	5400543
T68	282996	5400135
T69	282298	5399792
T70	282307	5399370
T71	282817	5399471
T72	282603	5399132
T73	283260	5398665

Table 4: Baie des Sables Turbine Layout used in Interference Model

4.2.1 Interference Prediction for Viewers of Ste-Marguerite-Marie Transmitter

Figure 9 show the predicted interference for viewers of the Ste-Marguerite-Marie CHAU-TV-1 transmitter (run CANbdsInt001).

This station is located to the south-east of the wind farm and emits at the VHF frequency of 60MHz. Although no widespread interference is predicted and no villages are directly affected, there are some small patches where viewers of the CHAU-TV-1 station might experience it. The easternmost and southernmost (red) patches are uninhabited, and there are dwellings only within those (red) patches close to the shore. The number of houses within these patches has been counted and a total of 42 houses located along the coast have been identified. These are the locations where interference is most likely as the signal the viewers are receiving travels through the wind farm.

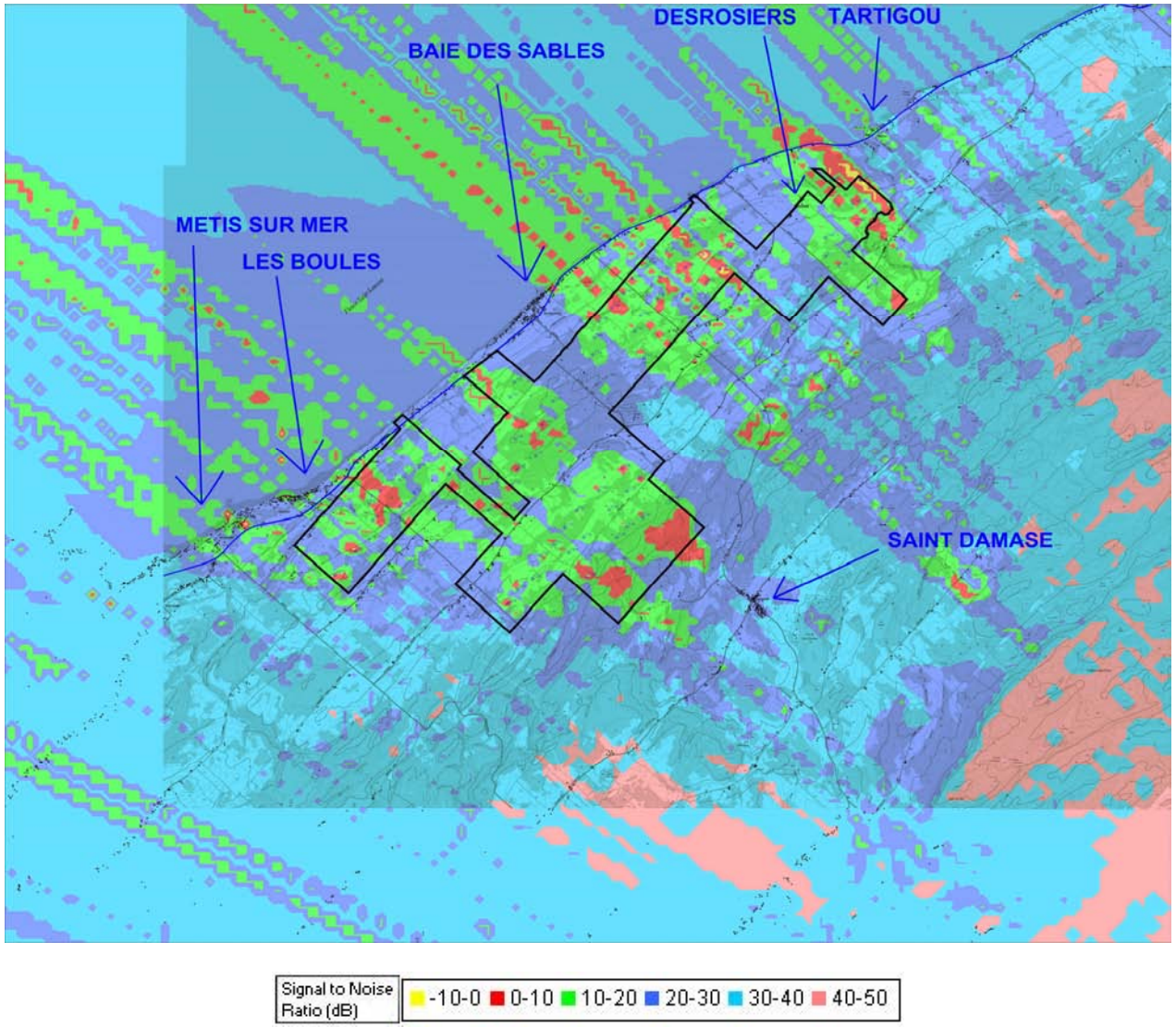

Figure 9: Predicted Interference to CHAU-TV-1 (Ste-Marguerite-Marie transmitter).

4.2.2 Interference Prediction for Viewers of Matane Transmitter

Figure 10 shows the predicted interference for viewers of the Matane CBGAT transmitter (run CANbdsInt003). This transmitter is located to the north-east of the wind farm. Interference is predicted in three different (red and yellow) regions, one to the north-east, one to the south-east and one to the west.

There are only 5 buildings located within the south-east region. There are 50 buildings located within the north-east region. The west region contains 20 buildings in the Metis sur Mer area, 168 buildings within the Les Boules area and 48 buildings within the rest of the region. Les Boules and a small part of Metis sur Mer are the only villages that might experience interference. This makes a total of 291 buildings. 12 of these 291 buildings have already been included in the previous cases of interference (section 4.2.1) and therefore only 279 buildings have to be considered as new potential cases of interference.

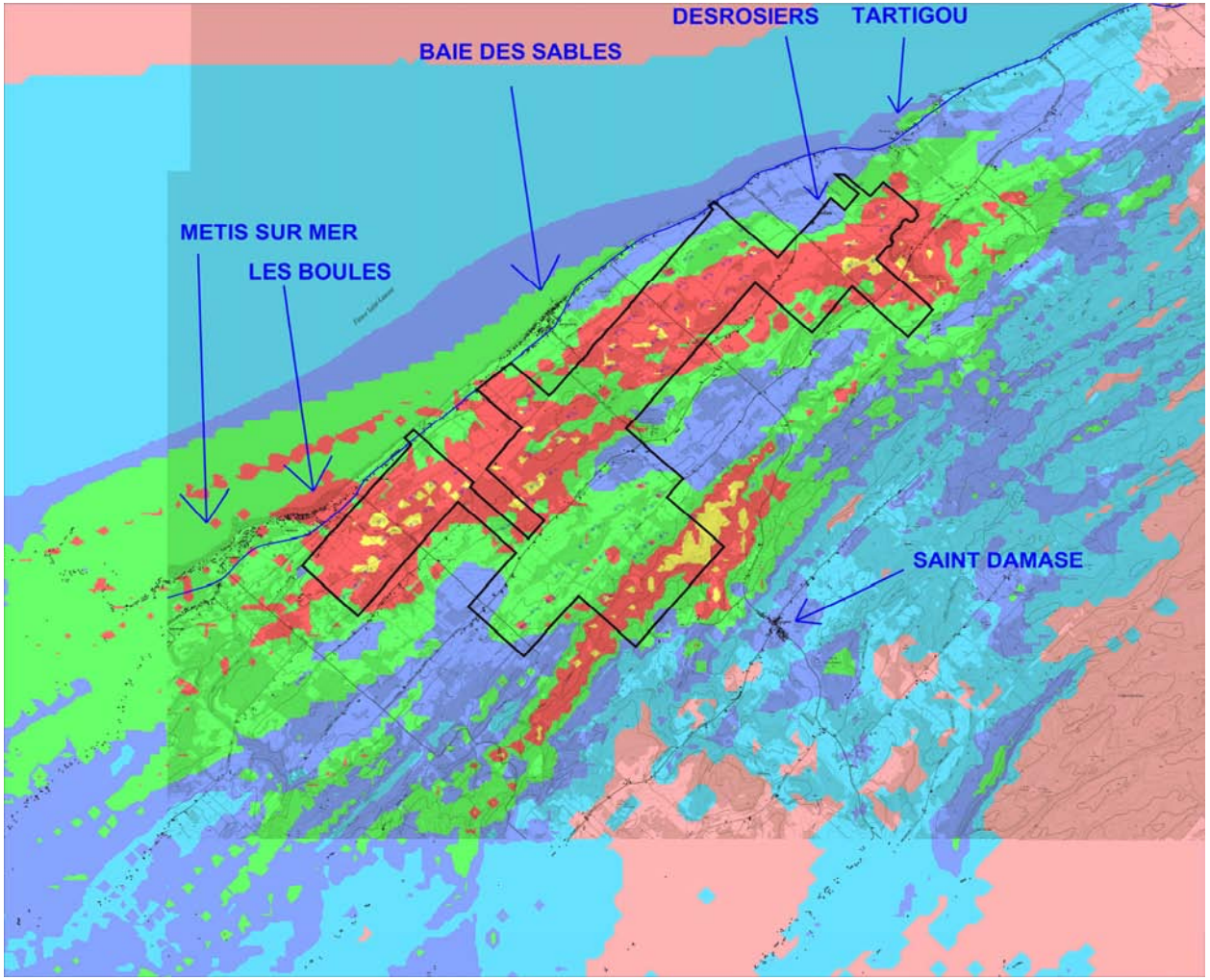

Figure 10: Predicted Interference to CBGAT (Matane transmitter).

4.2.3 Interference Prediction for Viewers of Rimouski Transmitters

Figures 11, 12 and 13 show the predicted interference for viewers of the Rimouski transmitters (CFER-TV, CIVB-TV and CJBR-TV). These three stations are located to the south-west of the site.

Interference to the CFER-TV station is predicted in a few areas (figure 11, run CANbdsInt004). Following the coast interference is predicted in a part of Baie des Sables (101 buildings), in a part of Tartigou (39 buildings) and to the west of Tartigou (52 buildings). There are also 26 buildings predicted to be affected at 2Km south of Tartigou. There are 88 buildings predicted to be affected in a large area (mostly outside the development boundary, black line) north of Saint Damase. Finally there are 20 buildings predicted to be affected in a large area south and south-west of Baie des Sables. This makes a total of 326 buildings. 95 of these 326 buildings have already been included in the previous cases of interference (sections 4.2.1 and 4.2.2) and therefore only 231 buildings have to be considered as new potential cases of interference.

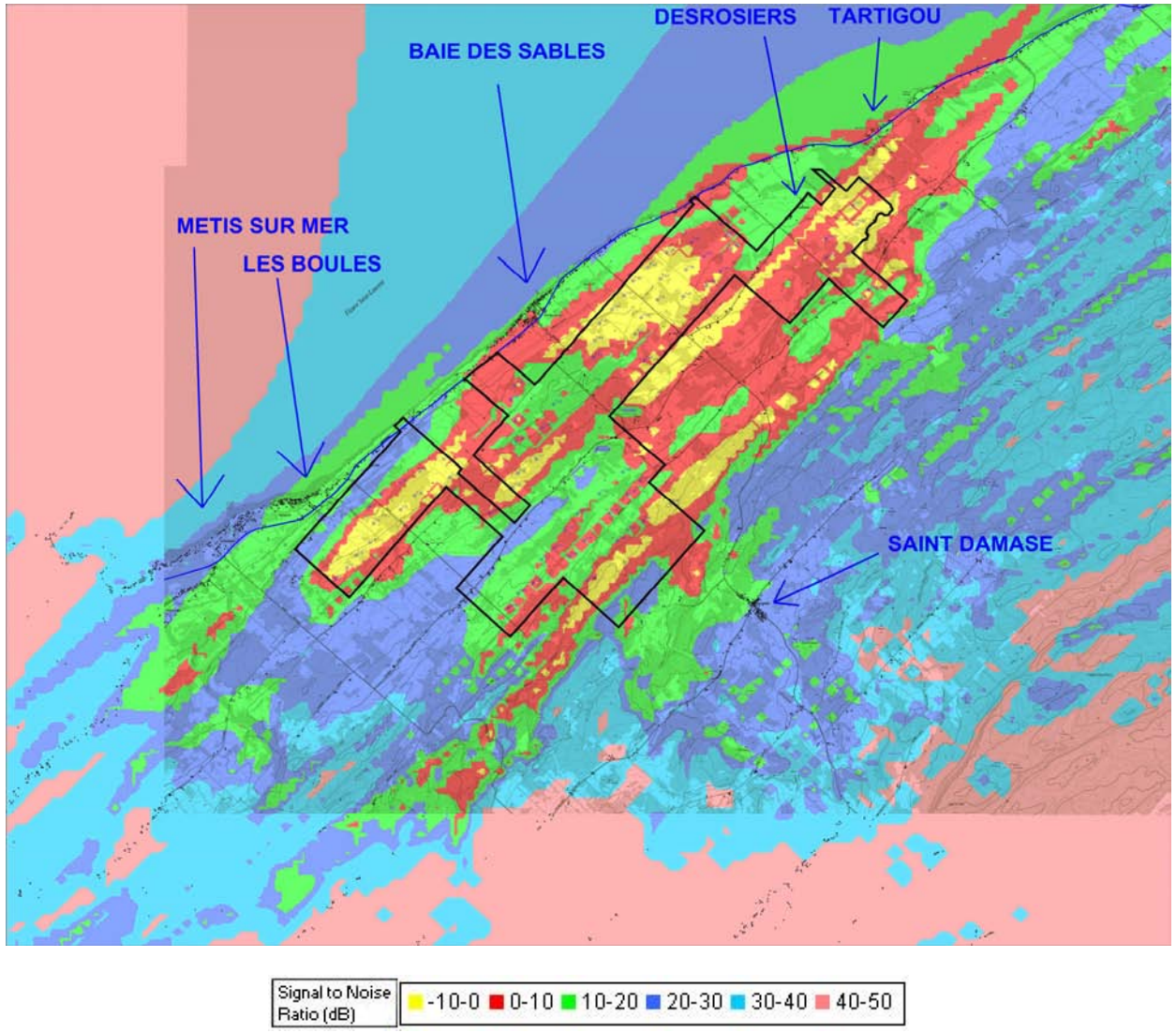

Figure 11: Predicted Interference to CFER-TV (Rimouski transmitter).

Interference to the CIVB-TV station is predicted in a few areas (figure 12, run CANbdsInt005). The predicted pattern is similar to that for CFER-TV as they are located in the same place. Following the coast interference is predicted in a part of Les Boules (130 buildings), Baie des Sables (220 buildings) and in Tartigou and to the west and east of it (154 buildings). There are also 26 buildings predicted to be affected at 2Km south of Tartigou. There are 105 buildings predicted to be affected in a large area (mostly outside the development boundary, black line) north of Saint Damase. There are 31 buildings predicted to be affected in an area north-west of Saint Damase. Finally there are 32 buildings predicted to be affected in a large area south and south-west of Les Boules. This makes a total of 698 buildings. 451 of these 698 buildings have already been included in the previous cases of interference (sections 4.2.1, 4.2.2 and 4.2.3) and therefore only 247 buildings have to be considered as new potential cases of interference.

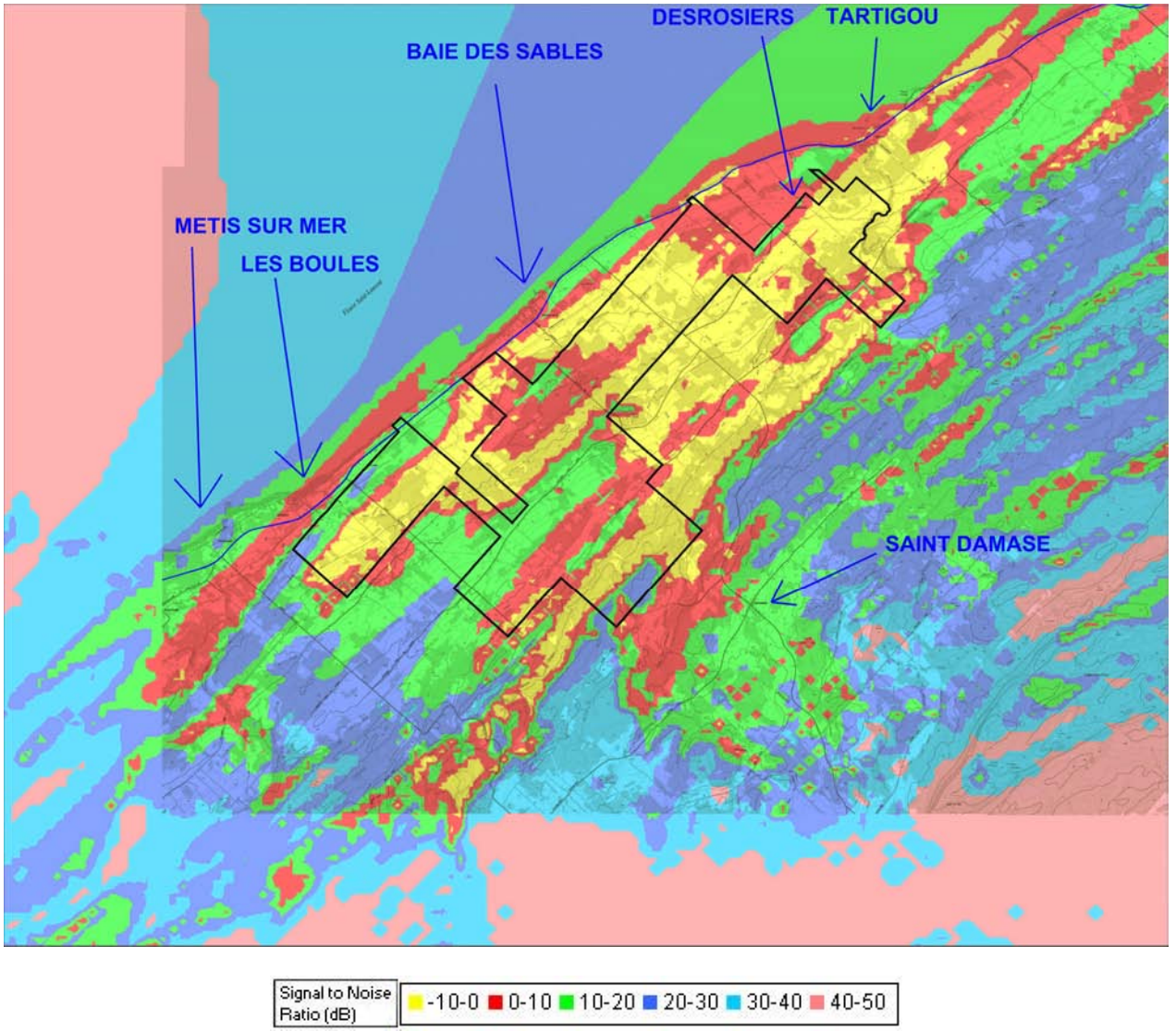

Figure 12: Predicted Interference to CIVB-TV (Rimouski transmitter).

Interference to the CJBR-TV station is predicted in a few areas (figure 13, run CANbdsInt007). Interference is predicted mainly in areas in the immediate vicinity of the turbines. Most of them are completely uninhabited. Only 12 buildings fall within the areas predicted to suffer interference. 10 of these 12 buildings have already been included in the previous cases of interference (sections 4.2.1, 4.2.2 and 4.2.3) and therefore only 2 buildings have to be considered as new potential cases of interference.

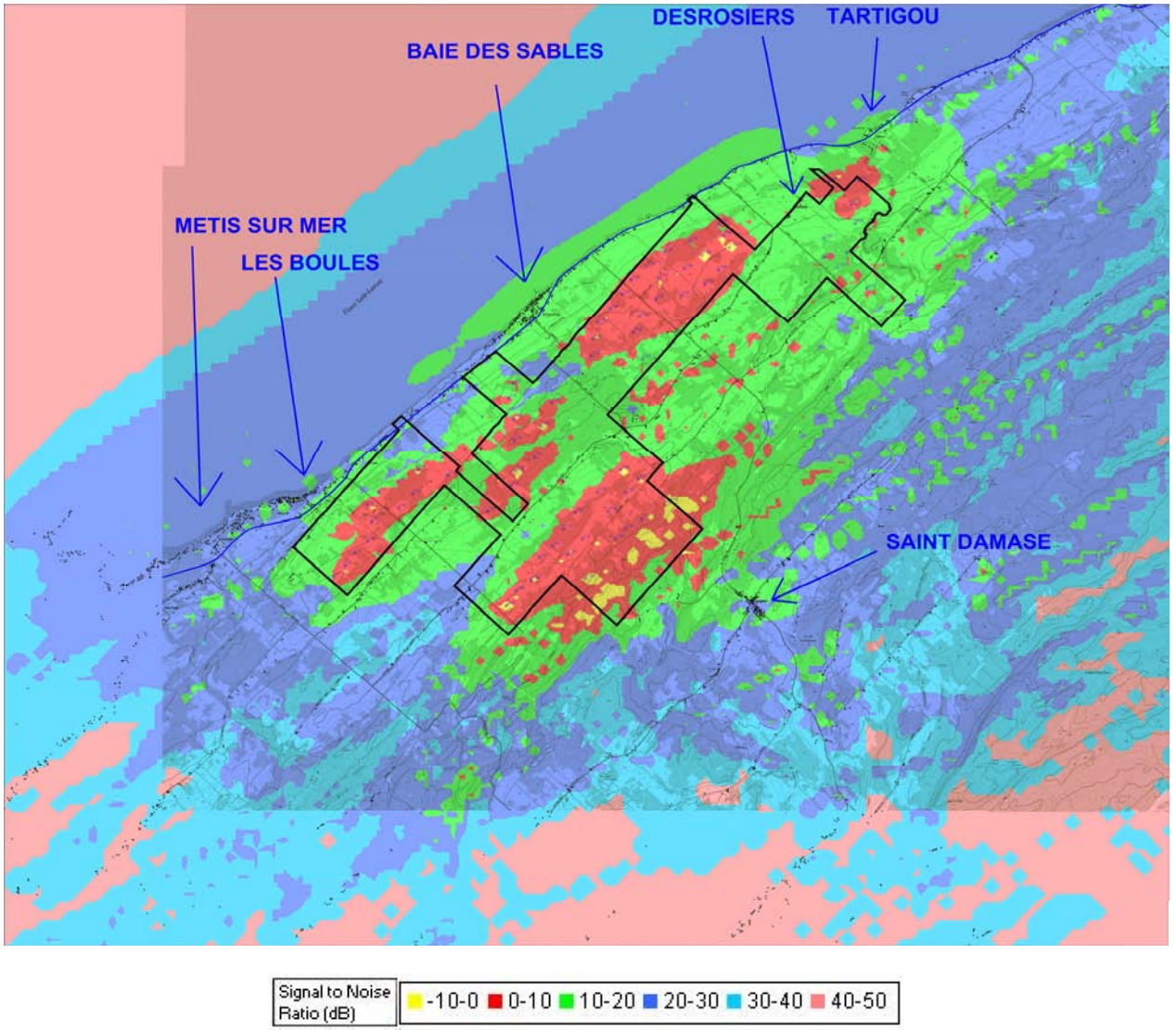

Figure 13: Predicted Interference to CJBR-TV (Rimouski transmitter).

4.2.4 Summary of Interference Predictions

Interference for viewers of the Ste-Marguerite-Marie CHAU-TV-1 station is only predicted in a few small patches (42 buildings mostly located along the coast).

Interference for viewers of the Matane CBGAT is predicted in three main regions comprising a total of 291 buildings. Only 279 of these 291 buildings have to be considered as potential new cases of interference. The largest areas affected consist of 20 buildings in Metis sur Mer and 168 buildings in Les Boules.

Interference for viewers of the Rimouski CFER-TV station is predicted in different areas comprising a total of 326 buildings. Only 231 of these 326 buildings have to be considered as potential new cases of interference. The largest areas affected consist of 101 buildings in Baie des Sables and 91 buildings around Tartigou.

Interference for viewers of the Rimouski CIVB-TV station is predicted in different areas comprising a total of 698 buildings. Only 247 of these 698 buildings have to be considered as potential new cases of interference. The largest areas affected consist of 130 buildings in Les Boules, 220 buildings in Baie des Sables and 154 buildings around Tartigou.

Interference for viewers of the Rimouski CJBR-TV station is only predicted in a few small patches (12 buildings). Only 2 of these 12 buildings have to be considered as potential new cases of interference.

The total number of buildings potentially affected by interference is 801.

4.3 Links between TV Stations

TV stations receive the TV signal they broadcast to the area they cover in different ways. The most common are via satellite or Rebroadcast Link (microwave link or 'off-air' signal from another station). Table 5 shows links between TV transmitters in the area [6]. Note that not only the stations identified to be covering the area, but all those located close to it, have been considered with the purpose of link identification.

Station	Receives Signal from	Sends Signal to
CHAU-TV-1 (Ste Marguerite Marie)	CHAU-TV (Carleton)	-
CBGAT (Matane)	(1)	CBST-17 (Blanc-Sablon)
		CBGAT-14 (Carleton)
		CBGAT-1 (Mont-Climont)
		CBGAT-19 (Lac-Humqui)
		CBST-11 (Harrington-Harbour)
		CBGAT-7 (St-Rene-De-Matane)
		CBGAT-11 (Ste-Anne-Des-Monts)
		CBST-12 (Tete-A-La-Baleine)
		CBST (Sept-Iles)
		CBST-14 (St-Augustin)
		CBST-16 (Riviere-St-Paul)
CFER-TV (Rimouski)	(2)	CFER-TV-2 (Sept Iles)
CIVB-TV (Rimouski)	Satellite	CIVF-TV (Baie-Trinite)

CJPC-TV (Rimouski)	Satellite	-
CJBR-TV (Rimouski)	(1)	CJBR-TV-1 (St-Marc De Latour)
CBGAT-1 (Mont-Climont)	CBGAT (Matane)	CBGAT-5 (Causapscal)

Table 5. Radio Links between TV Stations.

(1) The source of this station's main signal is specified as "NET" in the Industry Canada database [6] and not as another station. This suggests that this station is not fed by another station but by some other network means.

(2) The source of CFER-TV (Rimouski) station's main signal is specified as "TVA NETWRK" in the Industry Canada database [6] and not as another station. This suggests that this station is not fed by another station but by some other network means.

The wind farm is predicted to have no impact on any of these links.

5.0 MITIGATION TO TV INTERFERENCE

In the event of interference occurring, a solution is usually available by considering one or more of the following options appropriate for this area:

- Improved aerial system
- Alternative transmitter
- Digital Television- terrestrial or satellite
- Self-help system

Each of these options is evaluated below.

5.1 Improved aerial

A standard aerial has an angular discrimination of approximately 60 degrees. If the receiver suffering interference is positioned such that there is a large angular difference between the wanted and reflected signals, that is, the transmitter and the wind farm, then an improved aerial may help. Aerials with improved "back-to-front" ratios may also provide a solution, in rare cases, close to the wind farm where aerials receive a reflected signal from behind. Many other improvements can be made to a household's reception equipment, depending on requirements. For example the height of the aerial can be increased, the signal can be amplified and the aerial can be directed away from or shielded from the wind farm.

Figures 14 to 18 show the predicted interference for viewers of the five transmitters when an improved aerial is used [8]. As it can be seen, the use of this type of aerial improves the predicted interference for all viewers of the Ste-Marguerite-Marie CHAU-TV-1 station (see figure 9 and 14, run CANbdsInt001), all viewers of the Rimouski CJBR-TV station (see figure 13 and 18, run CANbdsInt007) and for most viewers of the Matane CBGAT station (see figure 10 and 15, run CANbdsInt003), including Metis sur Mer and Les Boules.

The use of this type of aerial would fix completely the predicted interference for viewers of the Rimouski CFER-TV station (see figure 11 and 16, run CANbdsInt004) at Baie des Sables (101 buildings), at the 26 buildings 2Km south of Tartigou and the 20 buildings south and south-west of Baie des Sables, and only partially in the rest of the areas. This makes an approximate total of 180 buildings out of 326.

The use of this type of aerial would fix completely the predicted interference for viewers of the Rimouski CIVB-TV station (see figure 12 and 17, run CANbdsInt005) at Les Boules (130 buildings) and at the 31 buildings north-west of Saint Damase, and only partially in the rest of the areas. This makes a total of 220 buildings out of 698.

Due to the fact that the signal from CFER-TV and CIVB-TV is excellent in all the area suggests that other methods of enhancing the TV reception and reducing the level of the unwanted reflected signal may offer feasible solutions to the interference created by the wind farm.

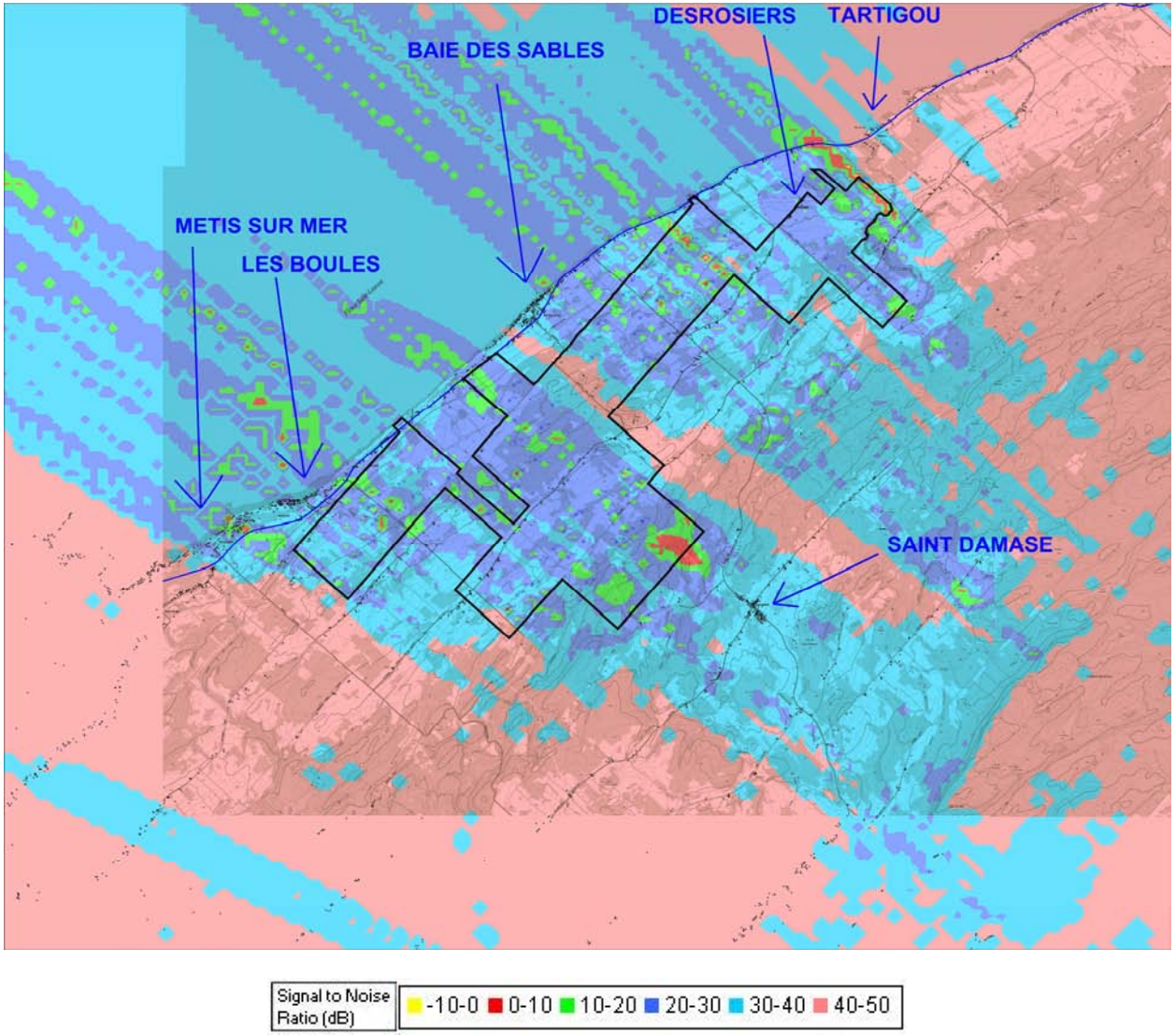

Figure 14: Predicted Interference to CHAU-TV-1 (Ste-Marguerite-Marie) using an improved aerial.

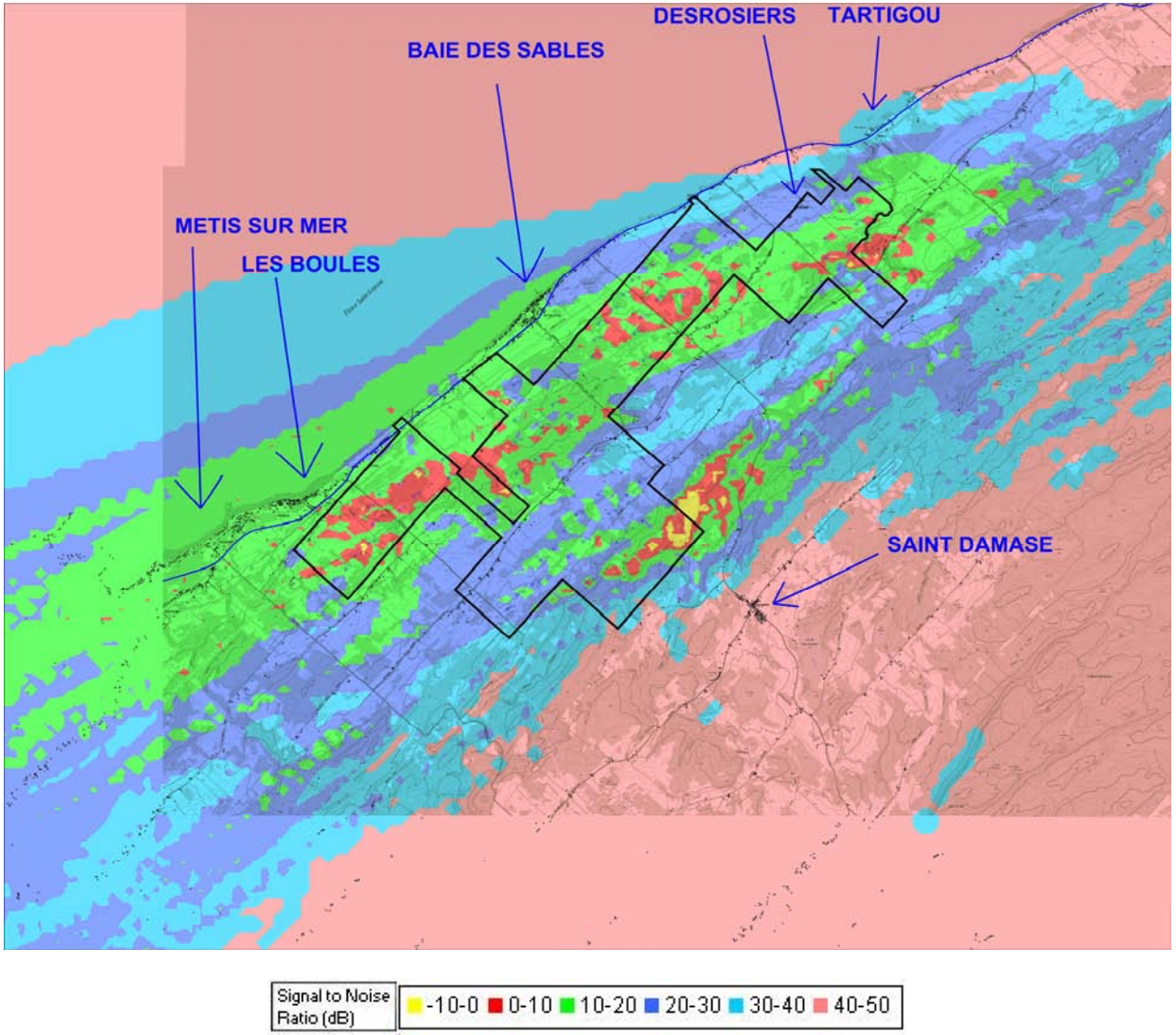

Figure 15: Predicted Interference to CBGAT (Matane) using an improved aerial.

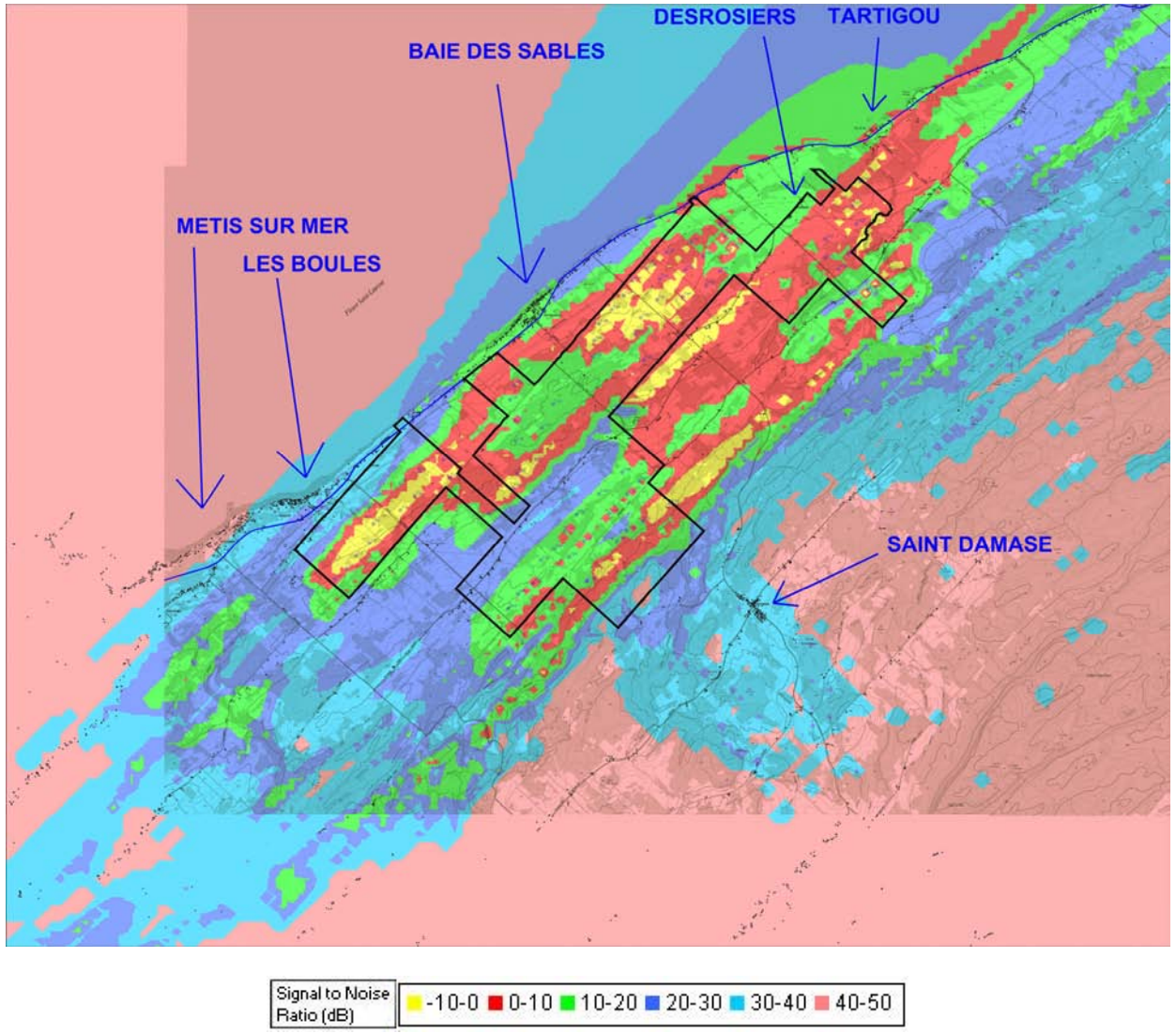

Figure 16: Predicted Interference to CFER-TV (Rimouski) using an improved aerial.

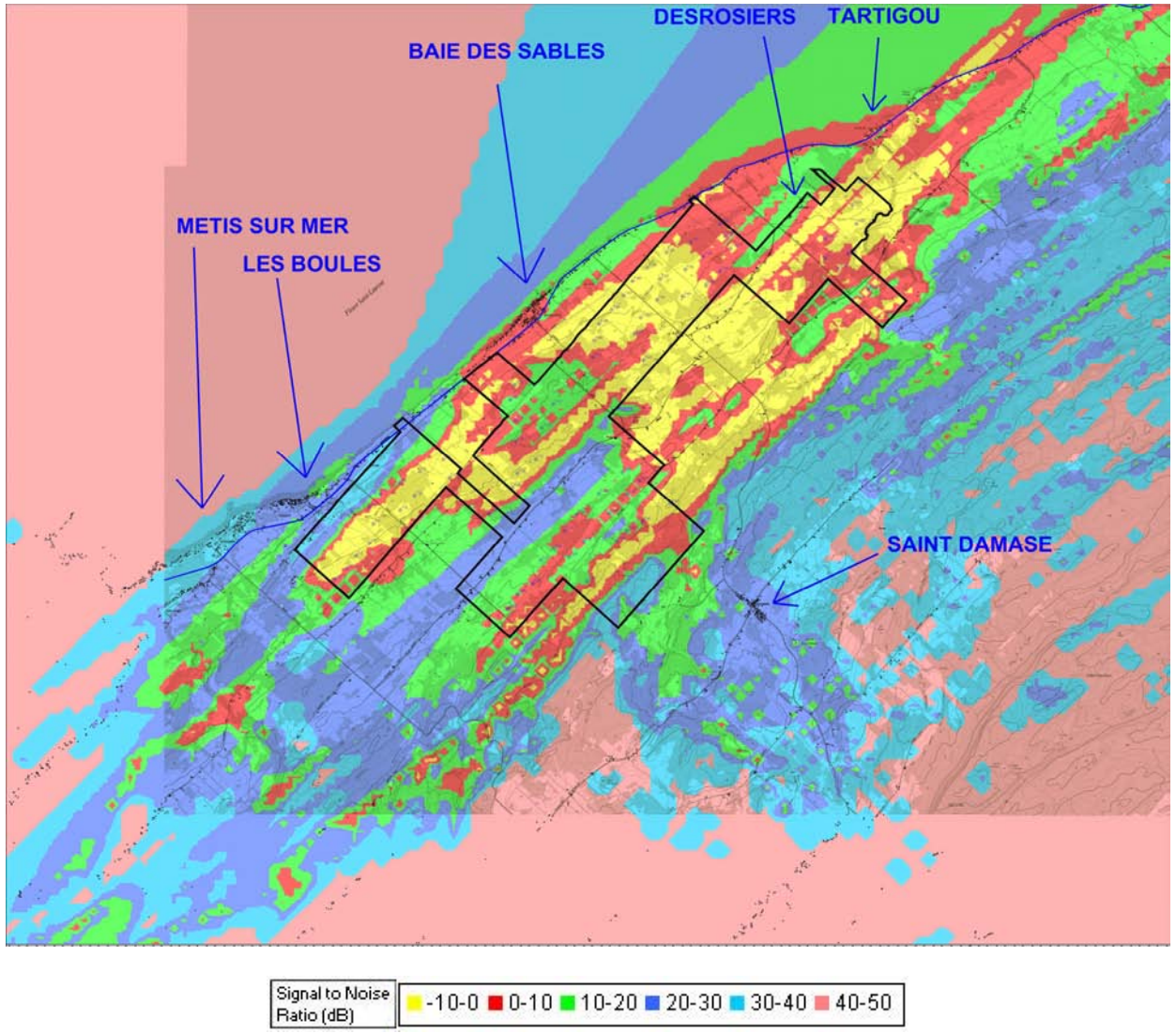

Figure 17: Predicted Interference to CIVB-TV (Rimouski) using an improved aerial.

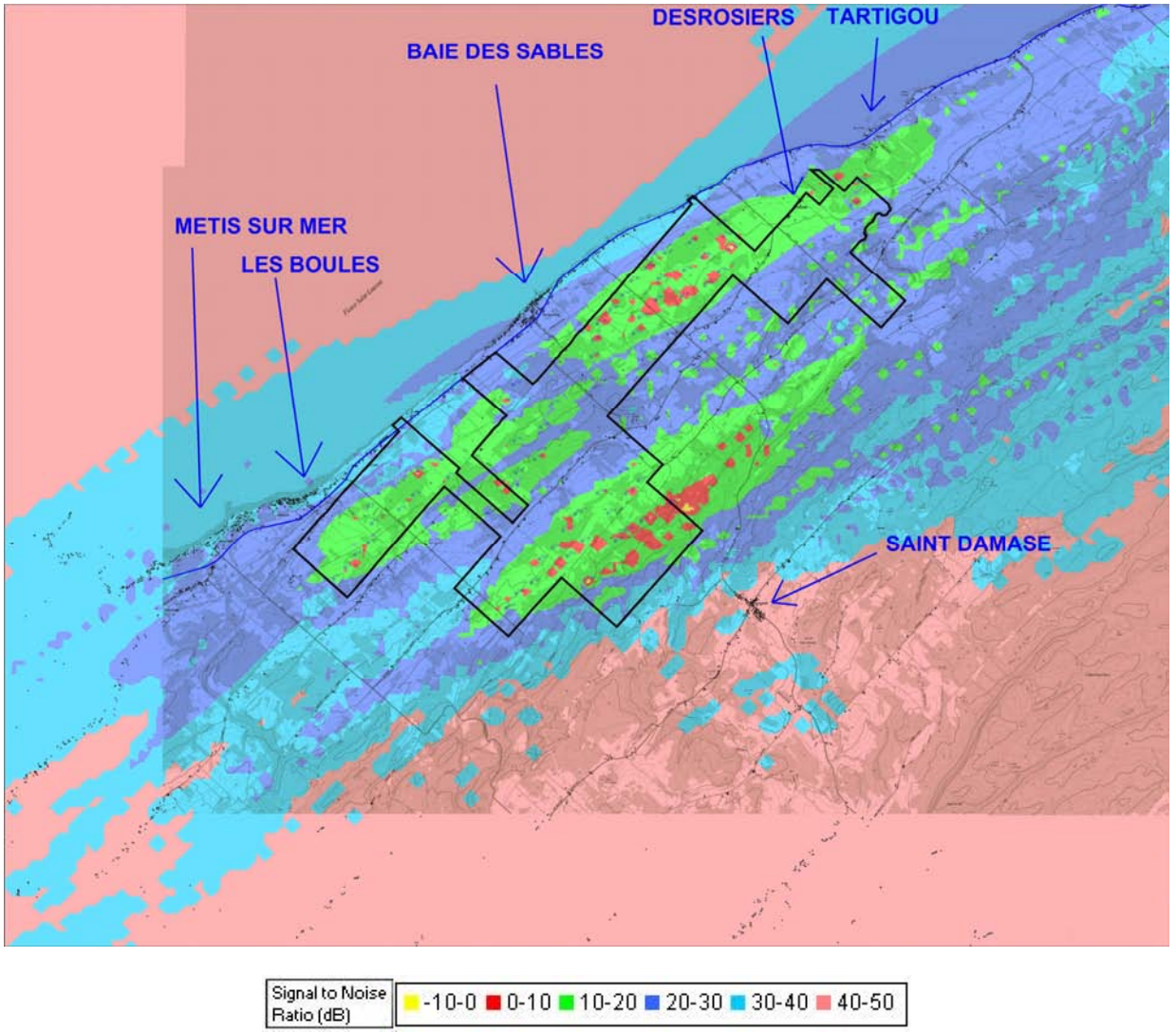

Figure 18: Predicted Interference to CJBR-TV (Rimouski) using an improved aerial.

5.2 Alternative Transmitter

Although this study has not identified alternative signals on-site for those transmitted by the CFER-TV and CIVB-TV, in the case of interference appearing it is advised that this option is further assessed by a TV engineer with knowledge of the local TV signal availability.

5.3 Digital Television

The impact of wind farms on terrestrial digital television (DTV) has not been fully assessed, but limited experience shows that it is less prone, though not immune, to interference than analogue signals.

The availability of cable TV, terrestrial DTV and satellite DTV are three options that should be further investigated in the event of interference appearing. An advantage of these mitigation options is that they may be viewed by the householder as an improvement to their television service rather than a restoration of service.

5.4 Remote Aerial System

A remote aerial system is an aerial installed at a suitable receiving site, free from interference, that transmits the unaffected signal via a cable run to each of the affected houses. Although this option can be expensive if long cables are required or many properties are involved, it is an option to be considered for those cases where no other options are available.

5.4 Self Help Transmitter

A self-help system is a small licensed relay station located to receive a clean signal and to transmit to affected households without interference from the wind farm. Normally new aerials are required as well as a license to operate the transposed frequencies. In the case of interference appearing and that none of the previous measures are available, a self-help transmitter is an option to be considered.

6.0 CONCLUSIONS

A prediction of interference to radio and TV reception around Baie des Sables wind farm has been made. The results show that the signal reception of two of the five TV stations considered in this report, namely Ste-Marguerite-Marie CHAU-TV-1 and Rimouski CJBR-TV, will not be significantly impaired (12 and 42 buildings potentially impaired in each case respectively). The results also show that the reception of the other three stations, namely Matane CBGAT, Rimouski CFER-TV and CIVB-TV, might be much more noticeably impaired (291, 326 and 698 buildings potentially impaired in each case respectively). The total number of different buildings potentially affected by interference is 801.

No interference to AM or FM radio reception is predicted.

It has been proposed that TV interference for viewers of Ste-Marguerite-Marie CHAU-TV-1, Matane CBGAT and Rimouski CJBR-TV, and for a number of viewers of the Rimouski CFER-TV and CIVB-TV stations can be mitigated by using an aerial with an improved angular

discrimination. The reception of the rest of the viewers of the Rimouski CFER-TV and CIVB-TV stations might enhanced also by any other type of improved aerial. This suggestion is supported by the excellent quality of these signals in all this area. The availability of cable DTV, terrestrial DTV and satellite DTV are options to be further investigated in the case of interference appearing. A remote aerial system may also provide a solution in some of these cases.

The wind farm is predicted to have no impact on any of these RBL links.

This is a desktop study and has been undertaken assuming that viewers in the areas studied for each transmitter are actually tuned to that transmitter, but this may not be the case. This assumption has been taken in order to establish the worst scenario. If required it can be complemented with an on-field survey.

7.0 REFERENCES

[1] ITU-R Recommendation 805, "Assessment of Impairment to Television Reception by a Wind Turbine".

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[3] BBC Research Department Report RD 1992/7.

[4] "TV Measurements Near Lendrum's Bridge Wind Turbines", J.E.Goodson, Spectrum Planning Group, NTL, September 2003

[5] RES Internal Report: 01142R0003, "The RES TV Interference Model. Description and Validation", Santi Vila-Moreno, June 2003.

[6] Industry Canada (20/04/2004): Broadcasting Database and other Related Informations, Available online: http://spectrum.ic.gc.ca/infoback/dgse/english/baserade.html [Accessed: 23/04/2004]

[7] Sengupta, D.L. and Senior, T.B.A. (1994) Chapter 9, Electromagentic Interference from Wind Turbines, Wind Turbine Technology, Spera D.A., ASME PRESS (p: 479)

[8] Information from Blake Aerials Ltd.