AGNICO EAGLE

REHABILITATION OF AN ABANDONED MINING SITE WITH GOLDEX TAILINGS – 2017 UPDATE

Énergie et Ressources naturelles
Québec

MANITOU – GOLDEX PROJECT
AGENDA

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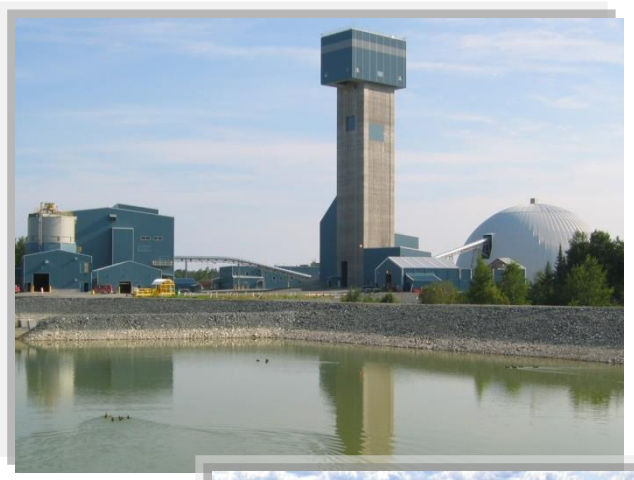
- Introduction
  - Sites presentation
  - Location
- Approach
  - Principle
  - Columns tests
  - Hydrogeology
- 2006-2007 Projects
  - Phase 1
  - Phase 2
- Update
  - Rehabilitation
  - Deposition plan
  - Signs of improvements
- Questions



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INTRODUCTION

SITES PRESENTATION
LOCATION

PROJET MANITOU – GOLDEX
GOLDEX MINE

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- Gold underground mine
- 2 km from city of Val d'Or
- Production start-up in April 2008
- Operation shut down temporary between October 2011 and October 2013
- Restart in October 2013
- Estimated reserves at 13 Mtm @ ≈1.6 g/tm
- Average daily tonnage of 6 800tm
- Waste rock and tailings non acid generation and non leachable

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PROJET MANITOU GOLDEX
SITE MANITOU

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- Site abandoned to MRNF
- Production between 1942 and 1979
- Widespread tailings on 6.5 km up to the Bourlamaque River
- Fish habitat affected by the Bourlamaque river
- 11 Mtm of acid generator tailings
- Contaminated on 200 ha
- Thickness of tailings of 1 to 17 m
- Water pH of 3.0

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MANITOU-GOLDEX PROJECT
LOCALISATION

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Goldex mine

City of Val d'Or

Manitou site

23 km

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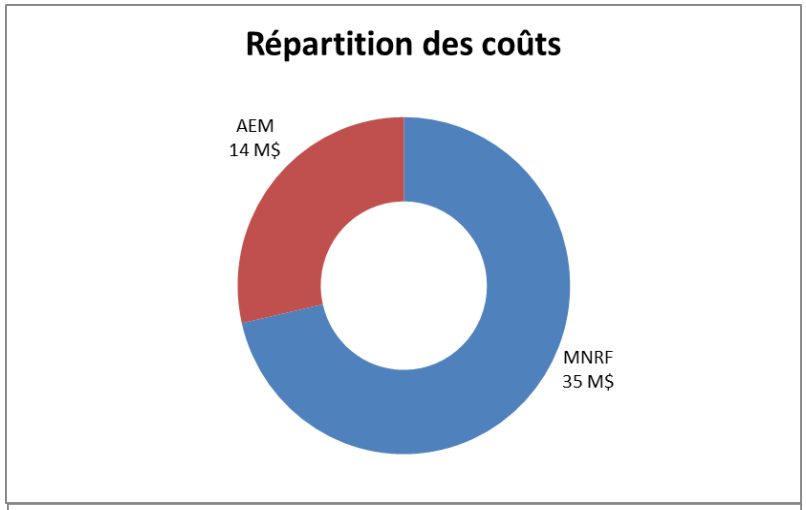
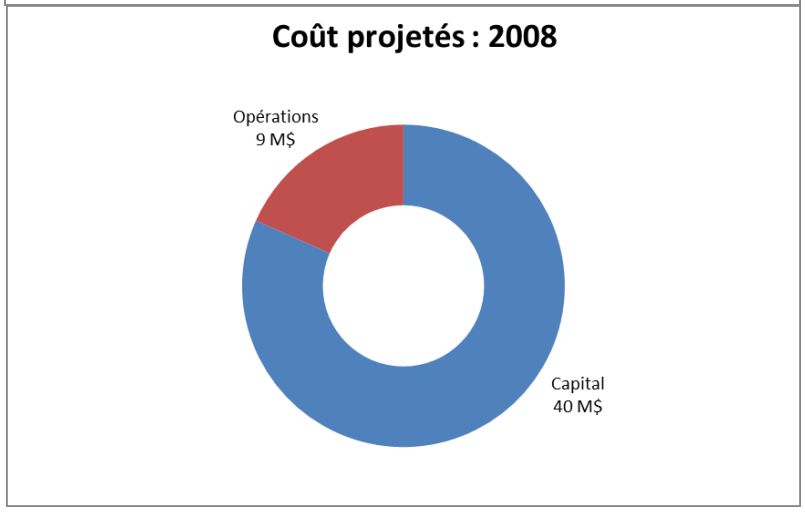
MANITOU-GOLDEX PROJECT
PARTNERSHIP

Agreement signed in 2006- MERN and AE
In order to complete Manitou rehabilitation





MRNF responsibilities

- Manitou site
- Pipeline, roads, bridge
- Equipments at Goldex
- To receive Goldex's tailings

AEM responsibilities

- Construction management
- Operation management
- Provide adequate quantities of tailings

Who are involved in Manitou-Goldex project?

Management committee (AE – MERN – independent expert)

Project collaborators

- Unité de recherche et de service en technologie minérale (URSTM)
- AMEC- geotechnical consultant
- Hydrogéologie Richelieu inc.
- Services Miniers Nord-Ouest
- Goldex operation team

Large work team!!

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APPROACH

PRINCIPLE
COLUMS TESTS
HYDROGEOLOGY

MANITOU-GOLDEX PROJECT
REHABILITATION CONCEPT

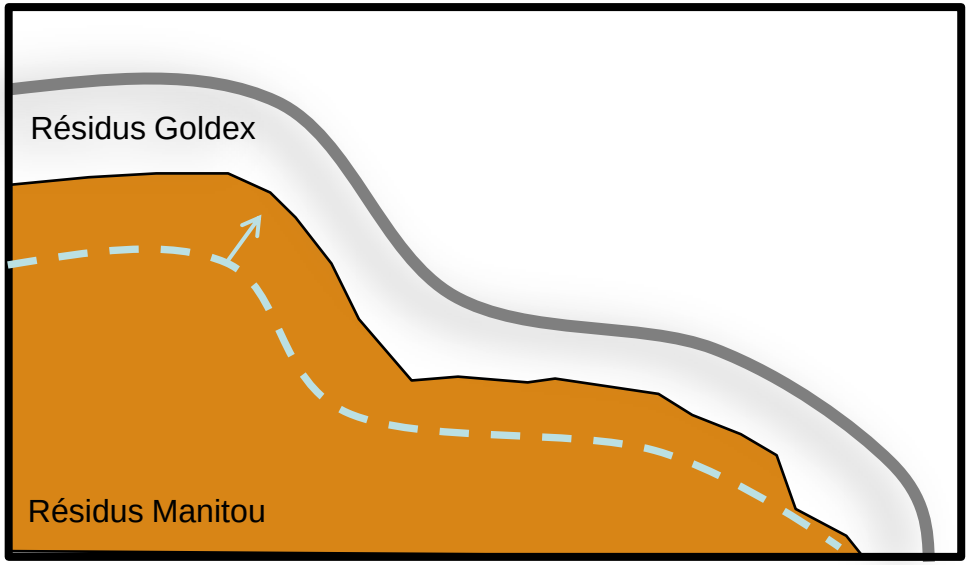
First ⟶ Goldex tailings characteristics

- Non acid generation
- Non-leachable
- Neutralisation Potentiel Net ≈ 60 kg $CaCo_3$/tonne
- No cyanide

Good materiel just like sand!!

Goal → Stop oxygen from accessing Manitou Tailings (sulfur)

Principle ⟶ monolayer cover and watertable increasing



PROJET MANITOU-GOLDEX

REHABILITATION APPROACH – COLUMNS TESTS

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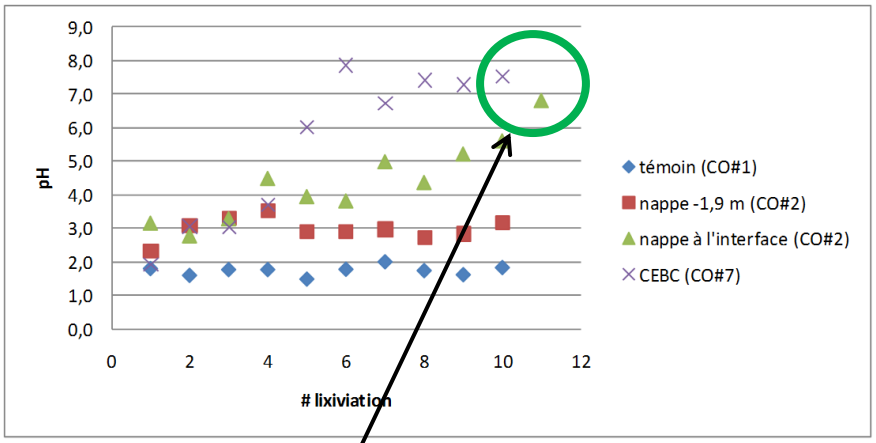

Conclusion – Equivalent results as a multilayers covering type

URSTM
Unité de recherche et de service en technologie minérale de l'Abitibi-Témiscamingue

PROJET MANITOU-GOLDEX
REHABILITATION APPROACH

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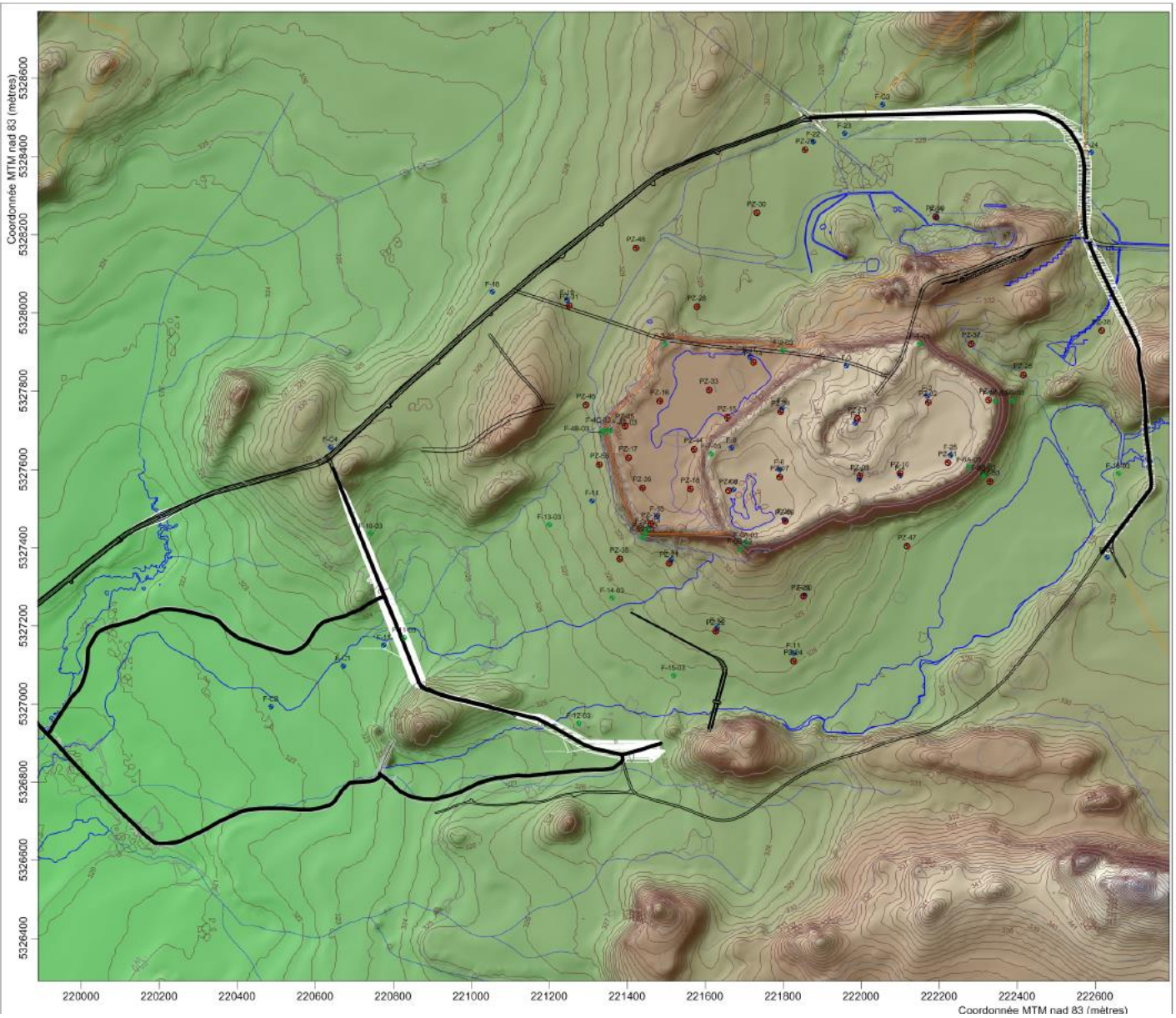


Légende

- Forage réalisé par Géocon, 2004
- Forage réalisé par l'URSTM, 2008
- Emplacement proposé pour les pointes filtrantes

358
354
350
346
342
338
334
330
326
322
318

0 250 500 750 1000
mètres

Fond cartographique et données d'élévation fournies par AMEC
plan autocad: Manitou_carte 2007 épurée.dxf

amec

Richelieu Hydrogéologie inc.

Titre

FIGURE 1: LOCALISATION
DES POINTES FILTRANTES INSTALLÉES

Projet

ÉTUDE HYDROGÉOLOGIQUE
SITE MANITOU, VAL D'OR
AGNICO-EAGLE LTÉE

Interprétation et dessin

Yves Leblanc, ing. géo.
M.Sc. Hydrogéologue

Date

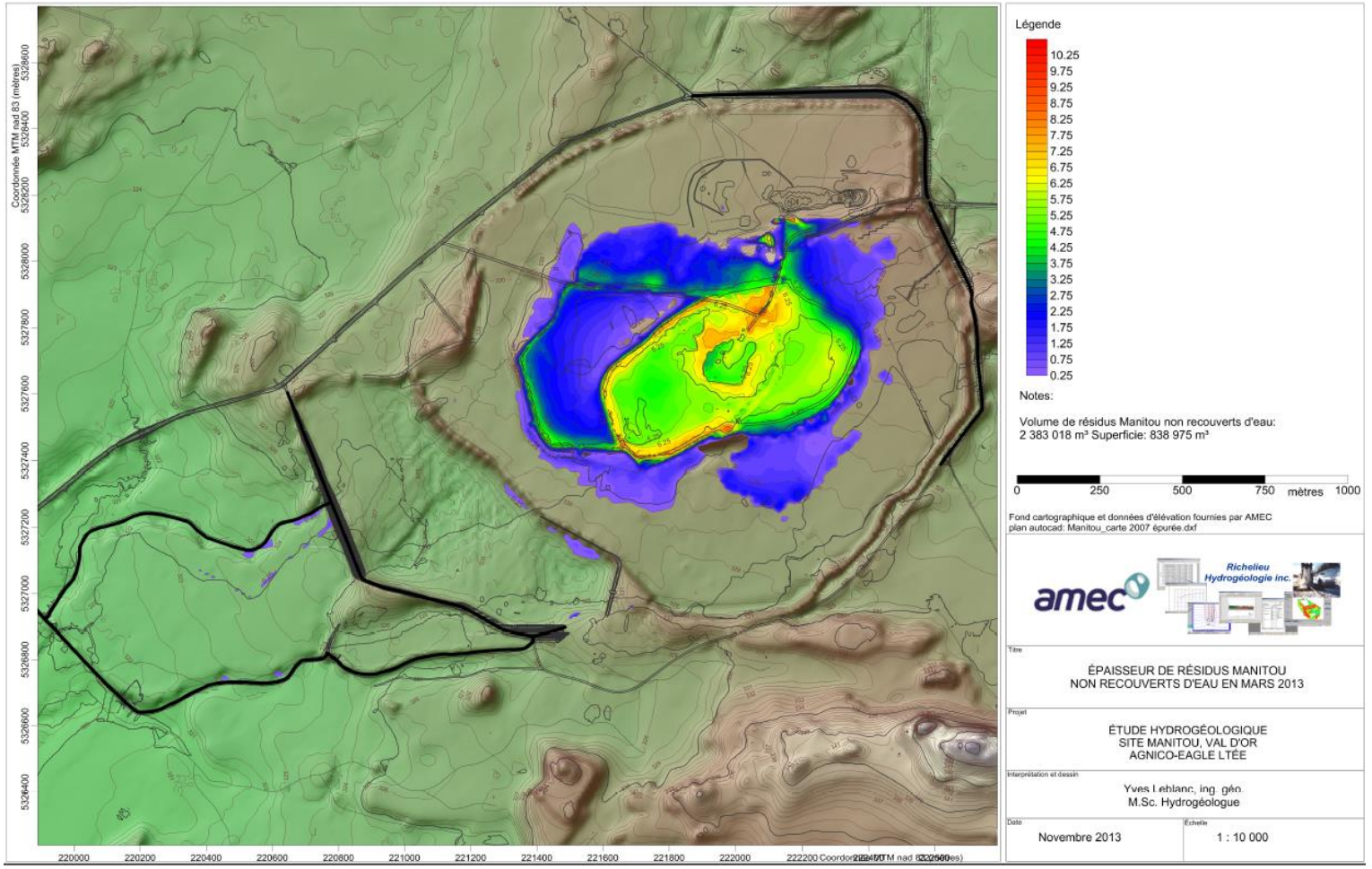
Le 30 AOÛT 2013

Échelle

1 : 10 000

PROJET MANITOU-GOLDEX
REHABILITATION APPROACH

Key aspect → *Hydrogeological model updated annualy*!

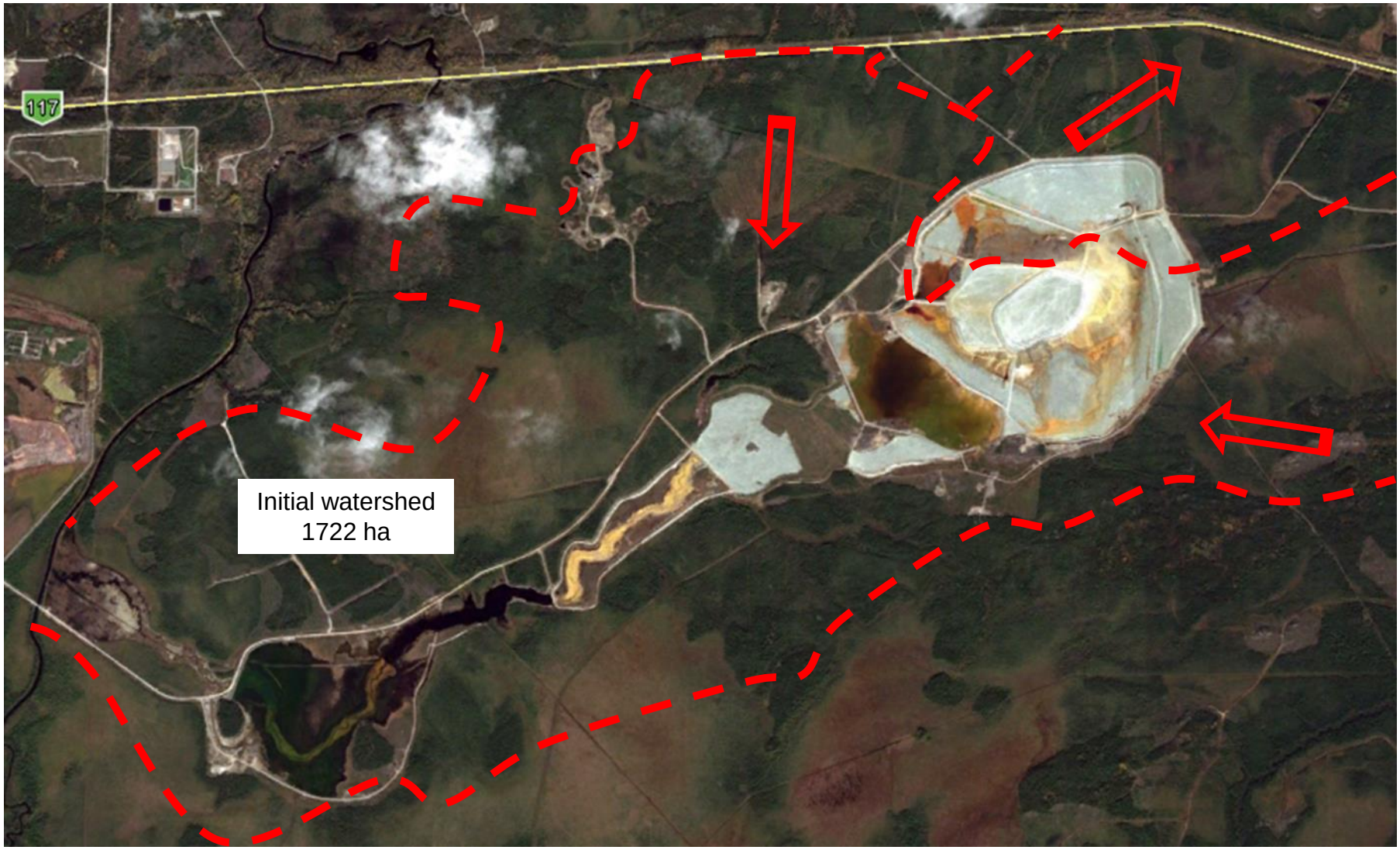


2006-2007 PROJECTS

PHASE 1
PHASE 2

PROJET MANITOU-GOLDEX

PHASE 1 – WATER MANAGEMENT



PROJET MANITOU-GOLDEX

PHASE 1 – WATER MANAGEMENT

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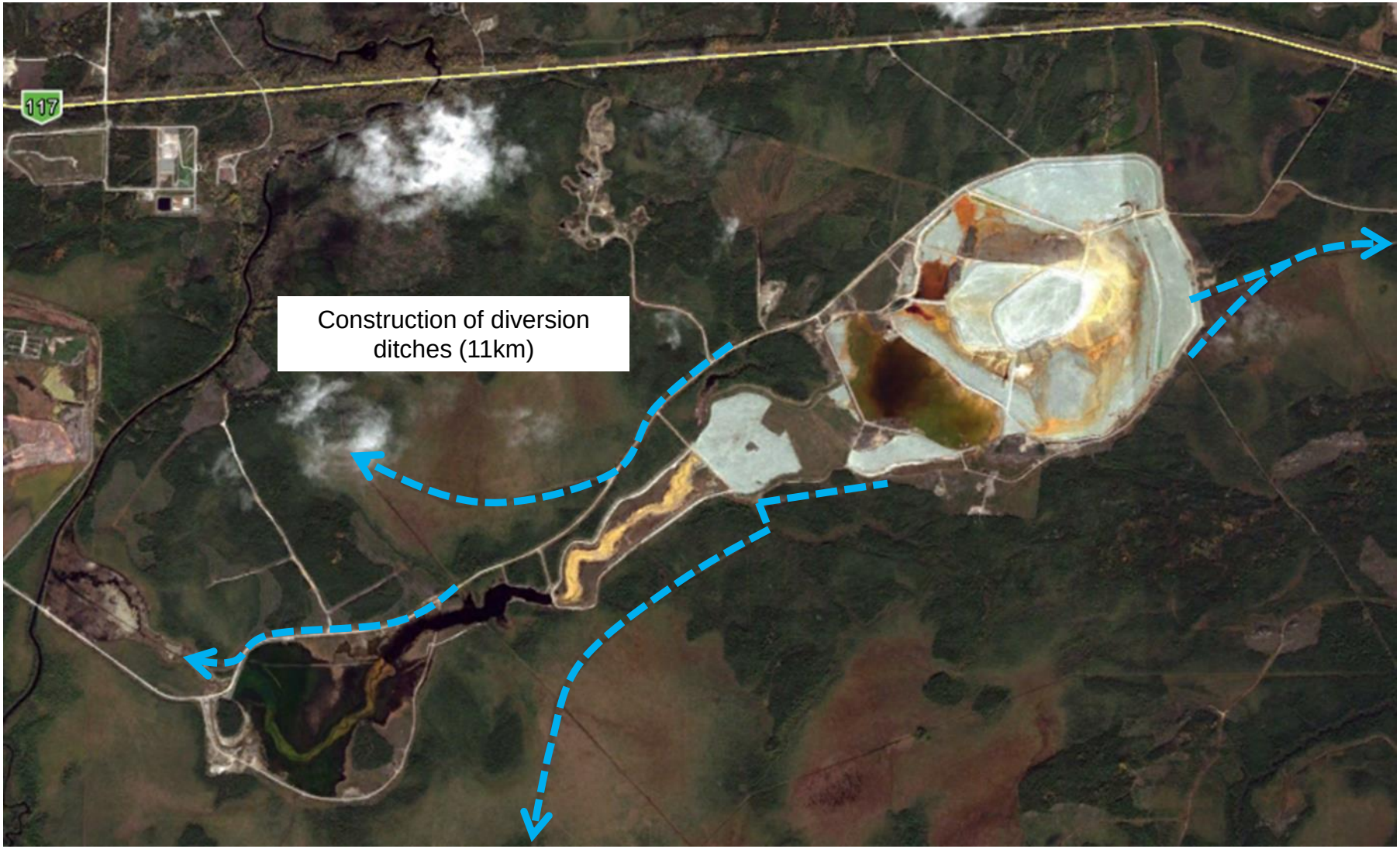
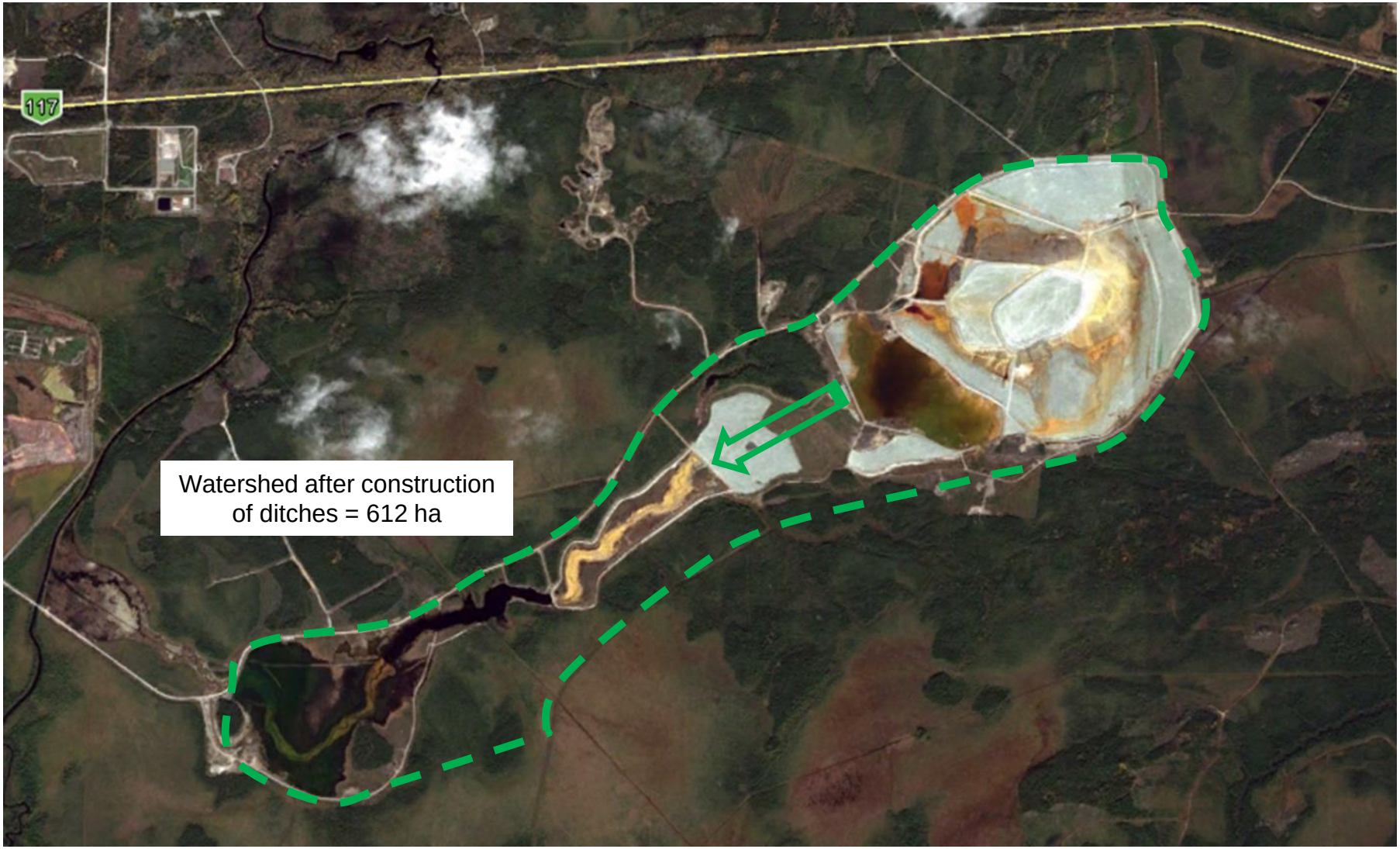


PROJET MANITOU-GOLDEX

PHASE 1 – WATER MANAGEMENT

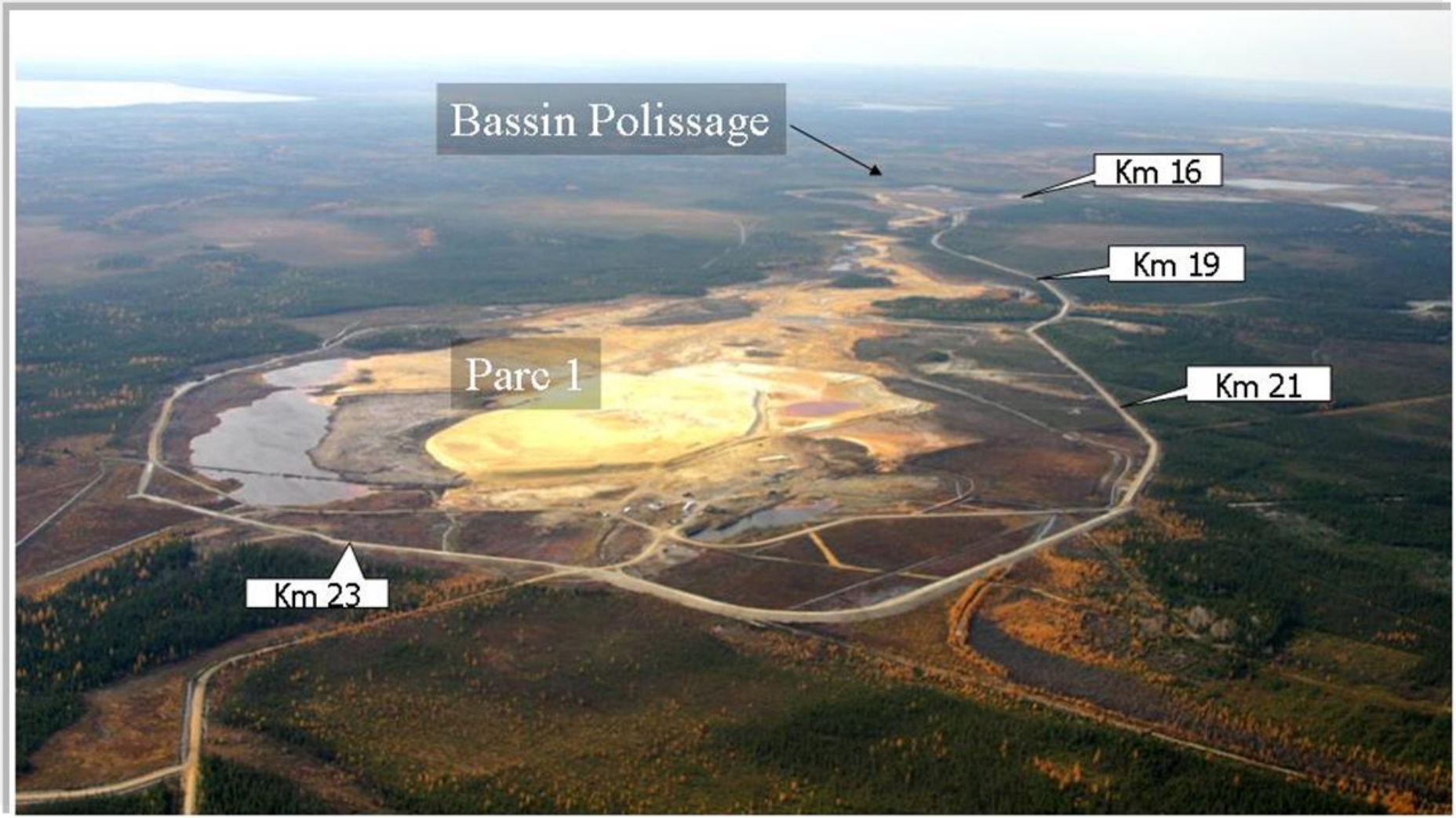


PROJET MANITOU-GOLDEX
PHASE 1 – EXCAVATION WORKS

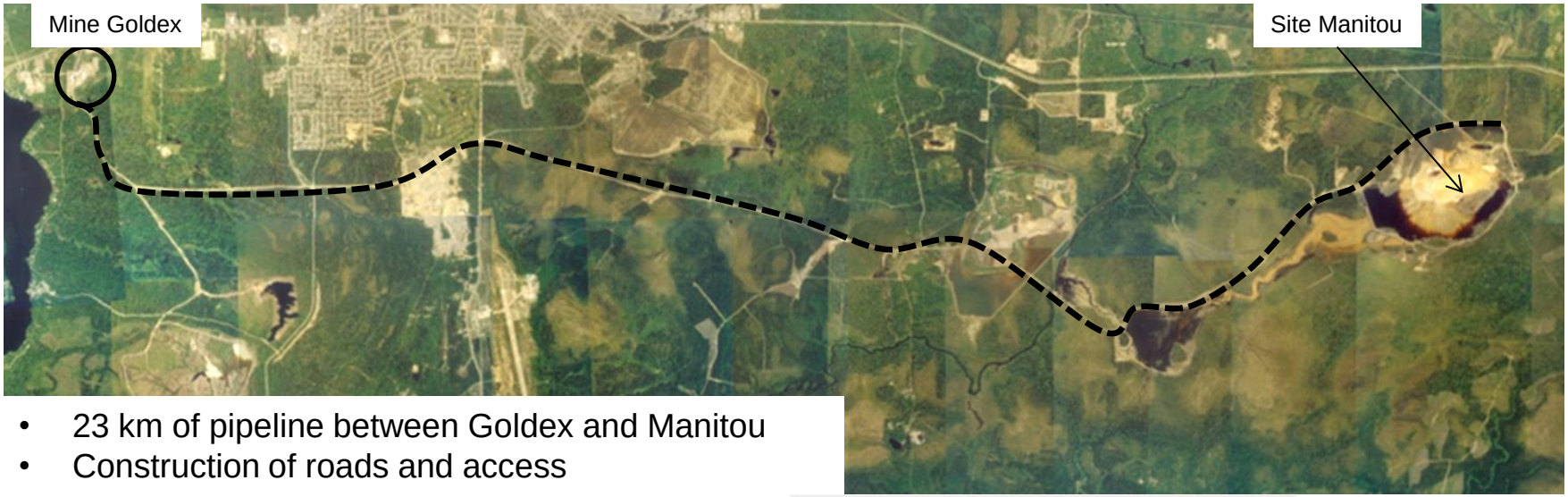
- Excavation of 350 000 m³ of Manitou tailings located near the Bourlamaque River during 2007 winter

PROJET MANITOU-GOLDEX

PHASE 2 – DYKES CONSTRUCTION



MANITOU-GOLDEX PROJECT
PHASE 2 – ROAD/PIPELINE/PUMPING STATION



- 23 km of pipeline between Goldex and Manitou
- Construction of roads and access

Pipeline installation

Pumping station

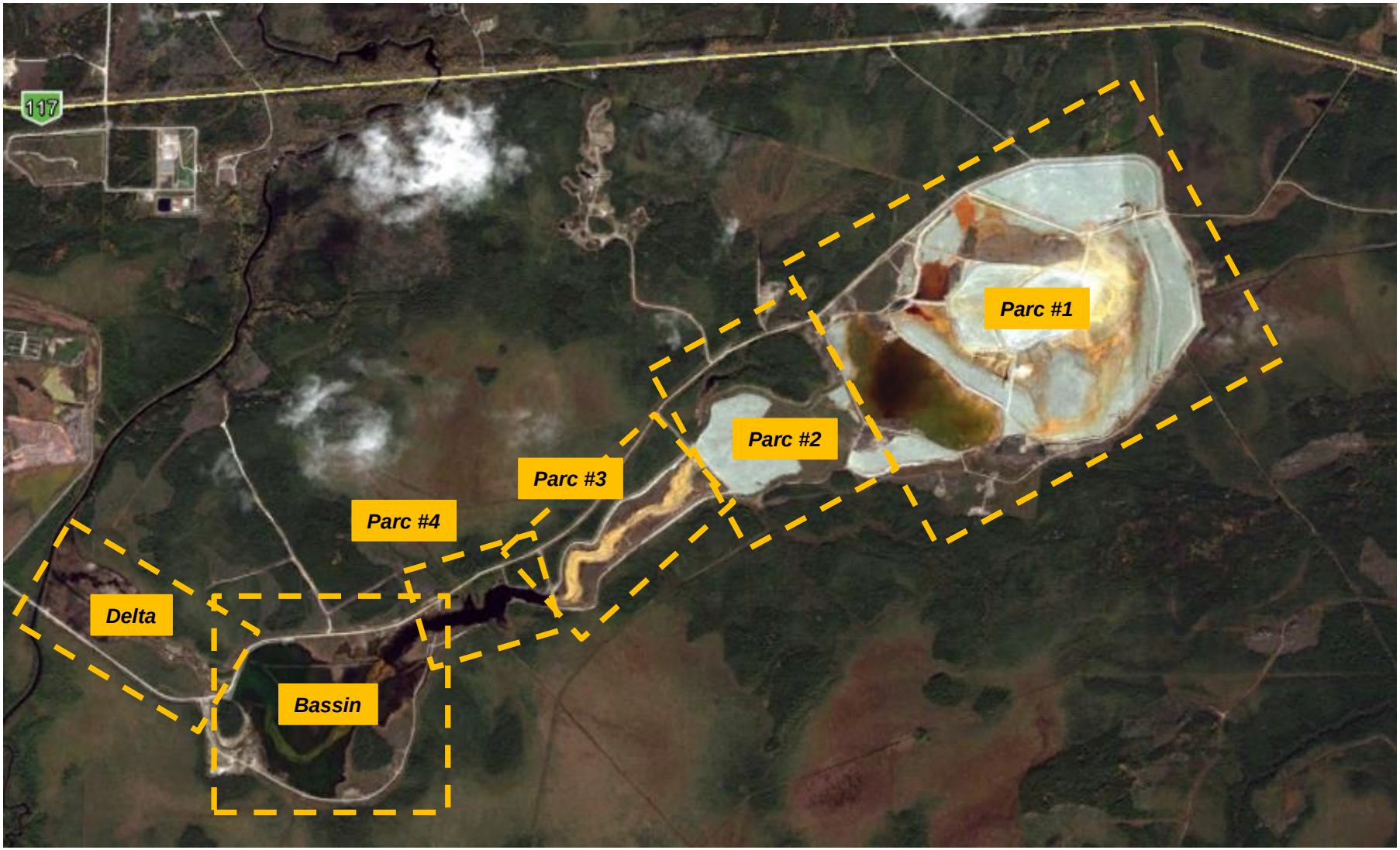
2 sets of 5 pumps (200 hp)

Pressure at 450 PSI

50% solid slurry

325 tm/hr

MANITOU-GOLDEX PROJECT
SECTORS ORGANIZATION



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UPDATE

REHABILITATION
DEPOSITION PLAN
SIGNS OF IMPROVEMENTS

MANITOU-GOLDEX PROJECT
ACTUAL STATEMENT

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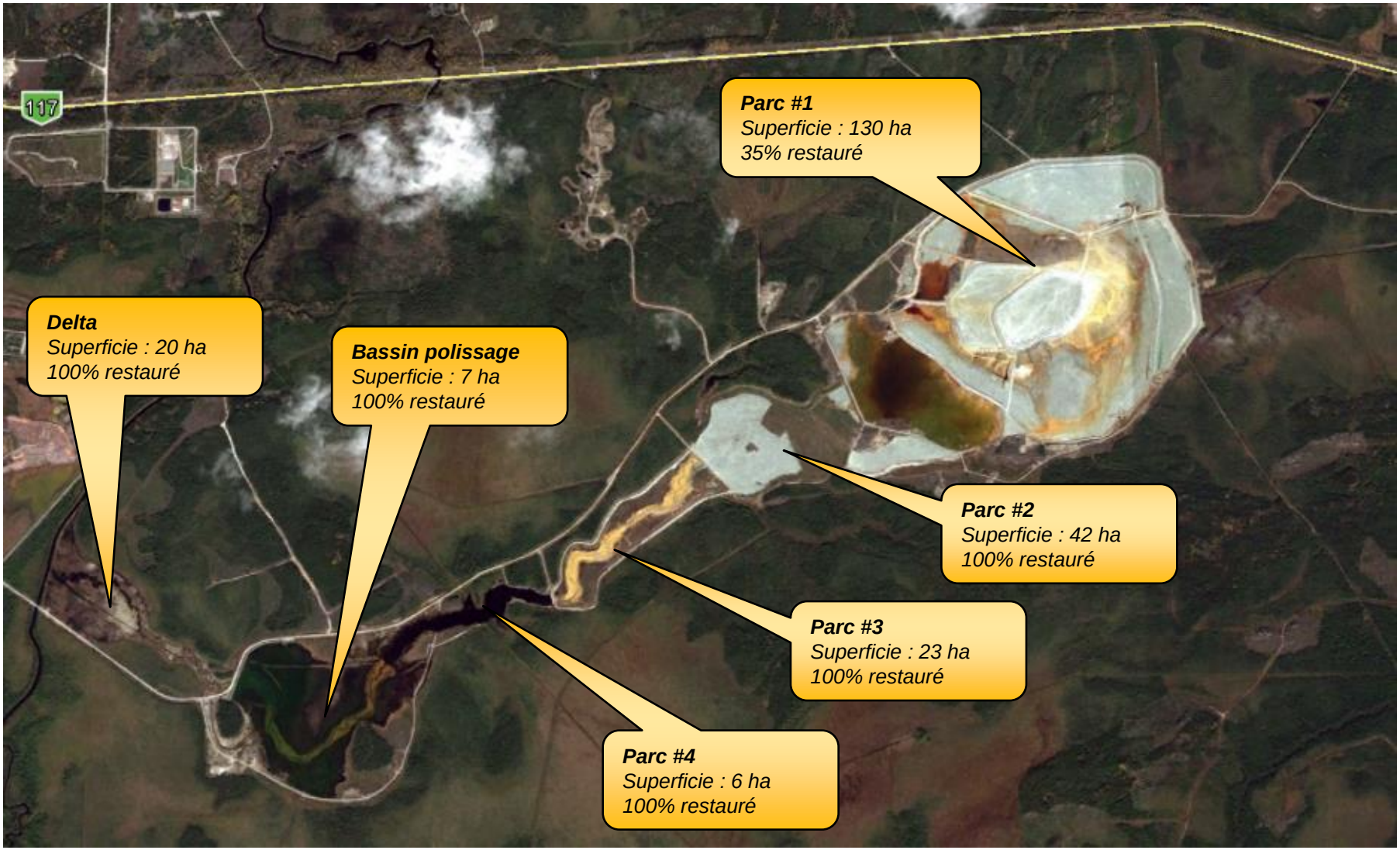

MANITOU-GOLDEX PROJECT

ROAD/PIPELINE/PUMP STATION – 10 YEARS AFTER

- Replacement of 1,5km steel pipe. 2 km will be replaced in 2017
- Conversion of 2 km of steel pipe in HDPE in 2016-2017

Km 0 à 3,5

- Abrasion in the bottom of the pipeline
- Presence of bacteoriogical corrosion

Km 16 à 21

- External corrosion of the pipeline due to acidic water of the wet land
- HDPE performance improvement over the last years allow to use it at higher pressure (210psi)

MANITOU-GOLDEX PROJECT
18.6 MTM SCENARIO

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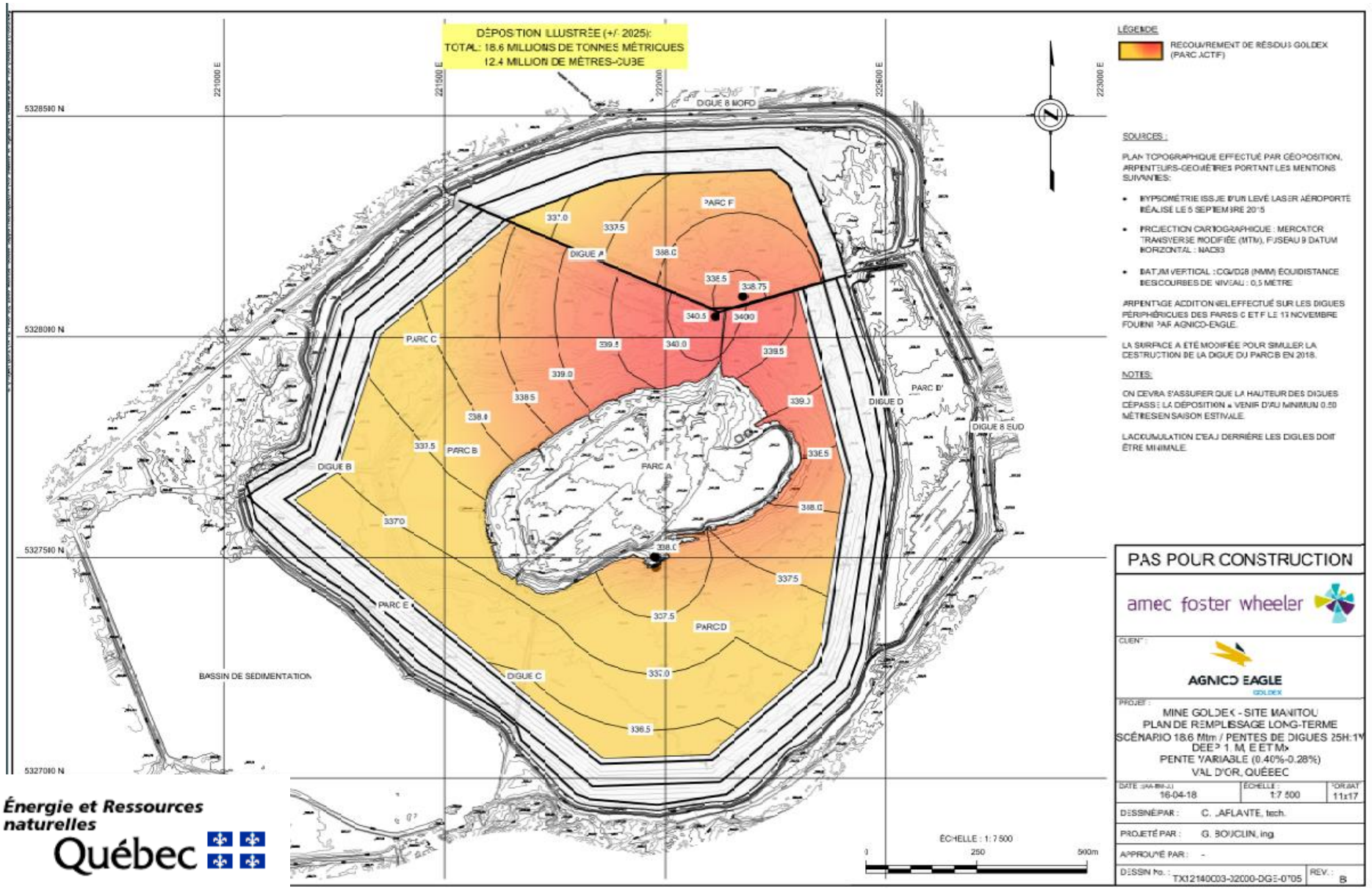

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MANITOU-GOLDEX PROJECT

SURFACE OF MANITOU TAILINGS – NON-SUBMERGED

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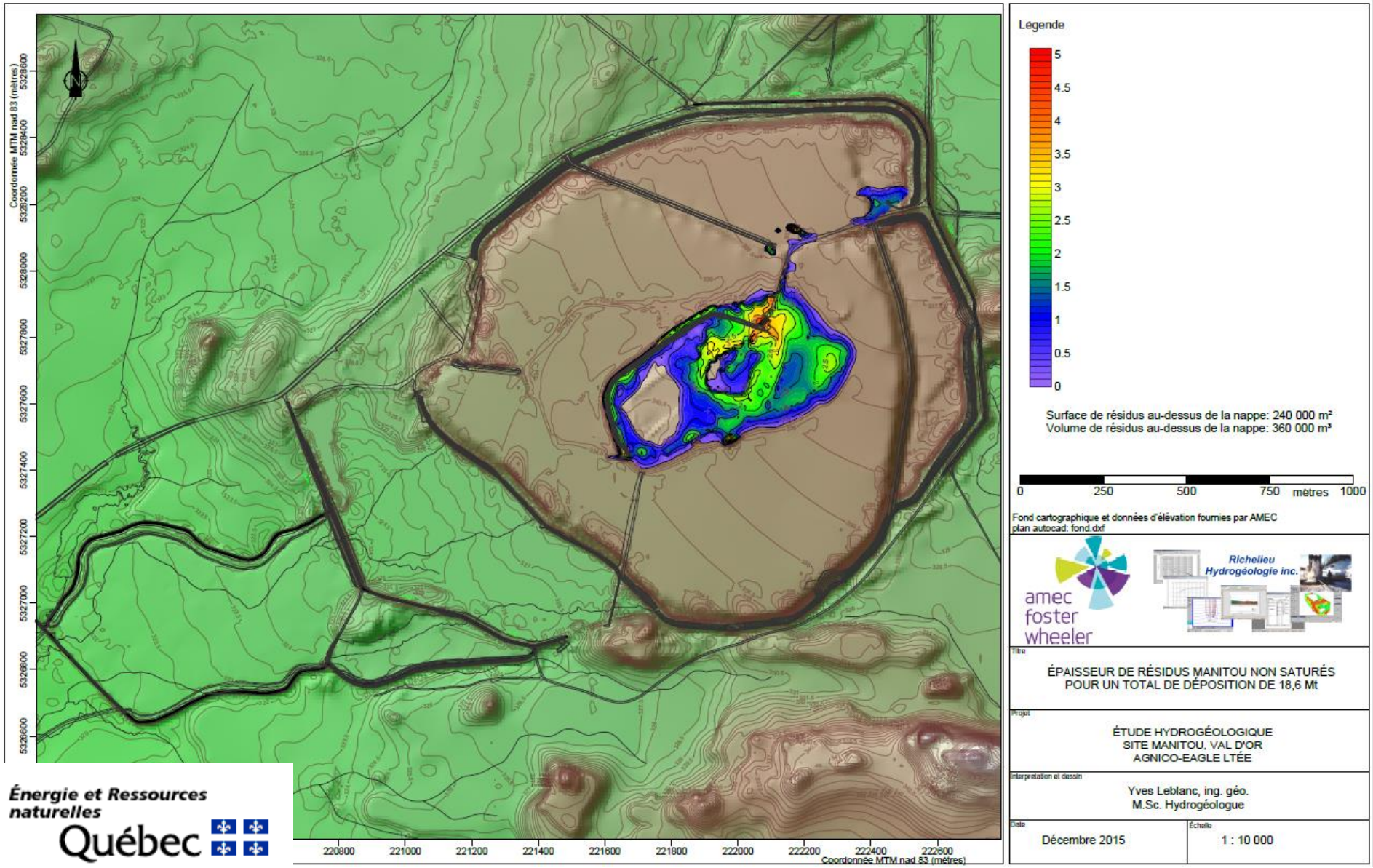

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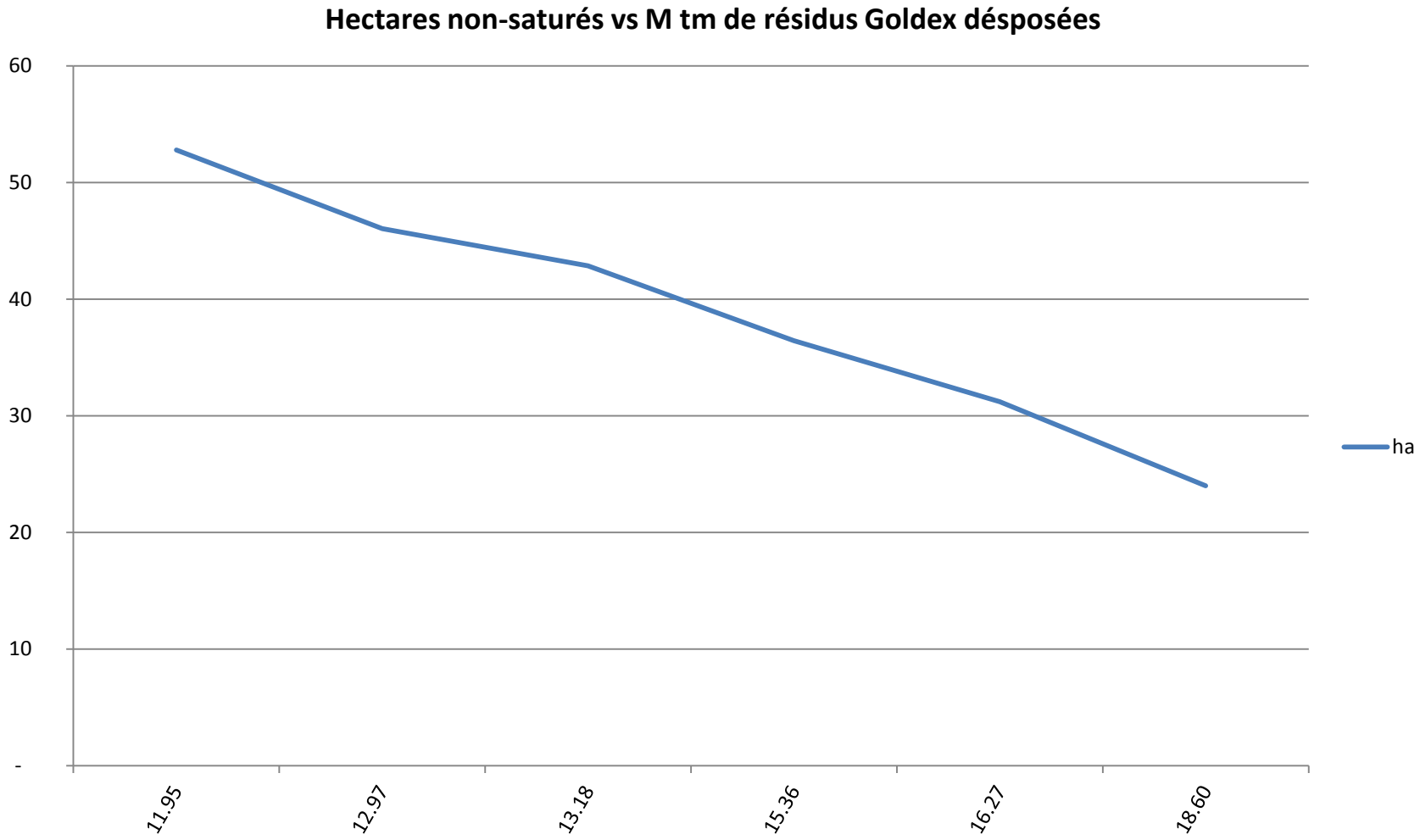
MANITOU-GOLDEX PROJECT

SURFACE NON-SUBMERGED VS TOTAL DEPOSITION OF TAILINGS



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MANITOU-GOLDEX PROJECT
EVOLUTION OF TAILINGS DEPOSITION

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MANITOU-GOLDEX PROJECT

SIGNS OF IMPROVEMENTS AT THE MANITOU SITE

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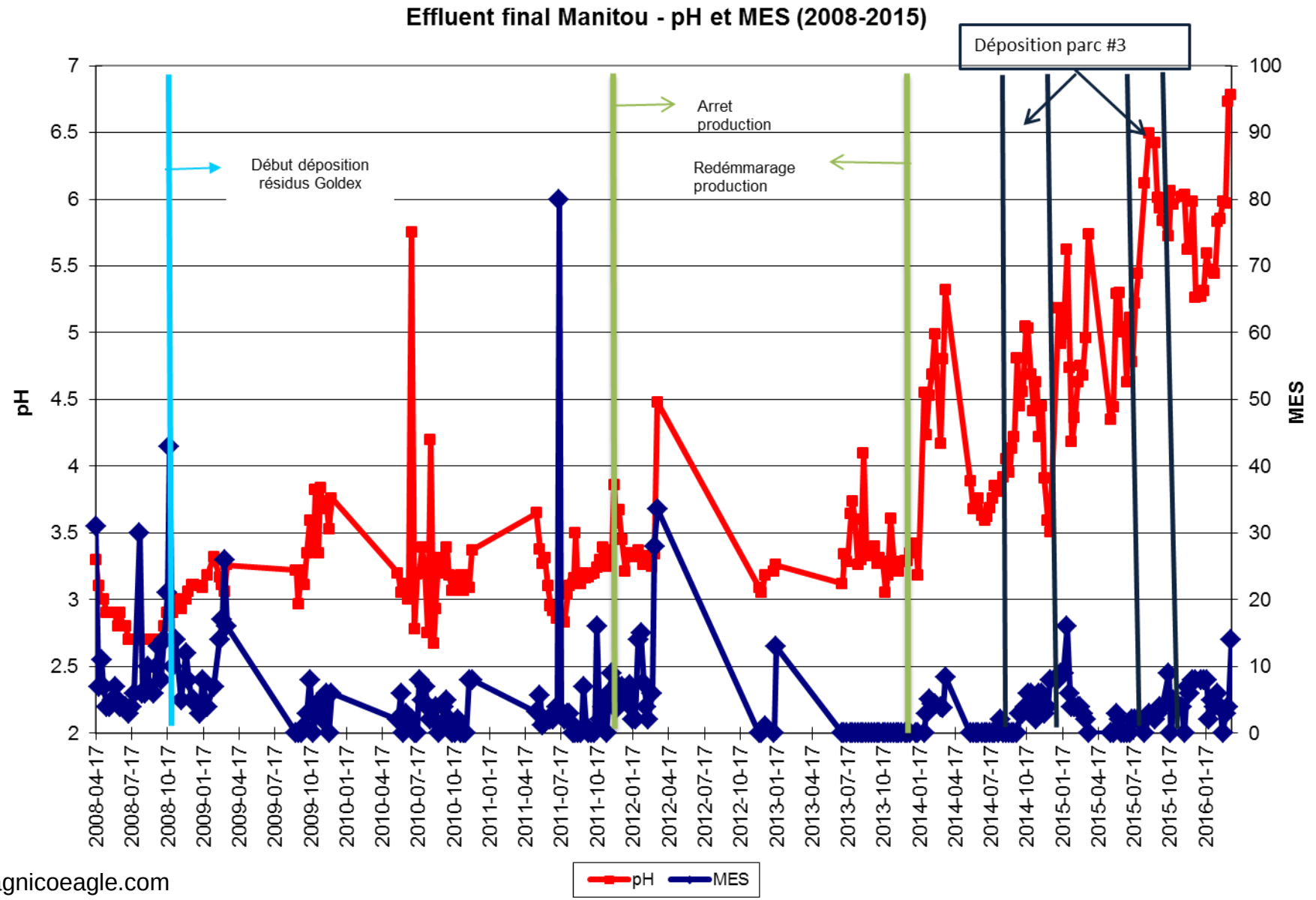
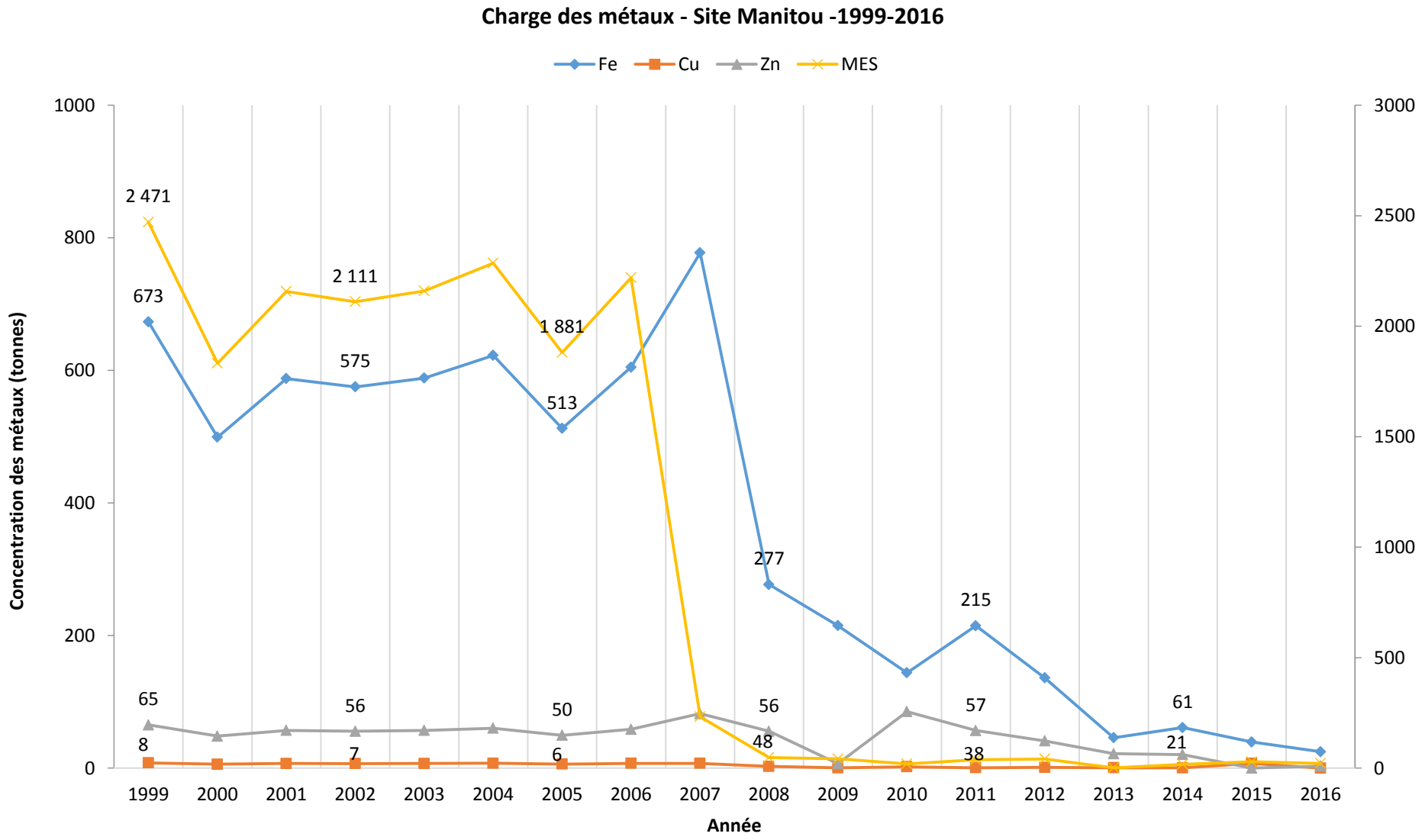


MANITOU-GOLDEX PROJECT

SIGNS OF IMPROVEMENTS AT THE MANITOU SITE



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SIGNS OF IMPROVEMENTS AT THE MANITOU SITE

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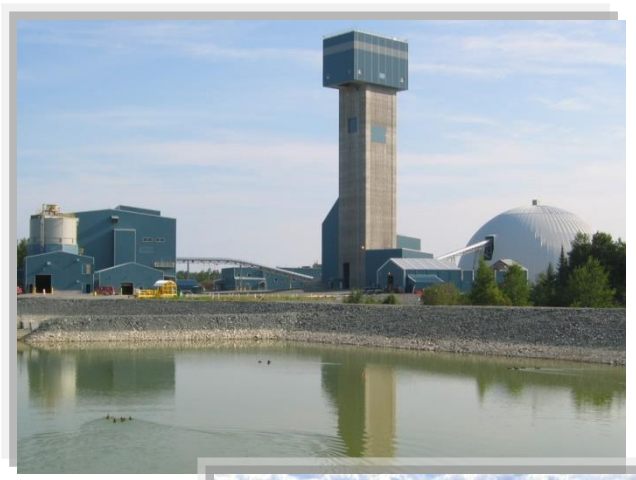
- Decreased flow of low pH effluent
- Upwarded trend of pH in effluent
- The return of living organisms in the Bourlamaque River
- Nesting in the new wetland of the effluent
- Good results from URSTM investigation follow-up program in park #2
- Modeling and measurements of the water table
- Revegetation testing on-going
- Actual statement – 50% of Manitou surface rehabilitated



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Questions???