LIFE Project Number

LIFE12 ENV/FI/000592

MIDTERM Report

Covering the project activities from 01/07/2013 to 30/9/2018

Reporting Date

31/12/2018

LIFE+ PROJECT NAME or Acronym

UPACMIC

Project Data

Project location	
Project start date:	01/07/2013
Project end date:	**Extension date:** 31/08/2020
Total Project duration (in months)	86 months (including **Extension of** 24 **months**)
Total budget	€
Total eligible budget	5 278 182,00 €
EU contribution:	2 500 339,00 €
(%) of total costs	47,3
(%) of eligible costs	50,0

Beneficiary Data

Name Beneficiary	Ramboll Finland
Contact person	Ms Tarja Niemelin (on behalf of Mr Pentti Lahtinen)
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Project Website	http://projektit.ramboll.fi/life/upacmic/

Abbreviations and names used in the report

ELY	Elinkeino-, liikenne- ja ympäristökeskus (Centre for Economic Development, Transport and the Environment (ELY Centre)
CB	Coordinating beneficiary
AB	Associated beneficiary
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
KAP	Knowledge, Attitude, Practices study
UUMA2	Finnish programme/network to foster the use of secondary materials in infrastructure construction, 2013-2017
UUMA3	Continuum of UUMA2, 2018-2020
EKOKEM	Previous name of current company FORTUM (the name is not revised in this report in the indicators lists as they are a copy from the proposal text)

Mines in the UPACMIC project:

HITURA	Mine, where the original implementation was planned according to application. Nickel enrichment sand.
PYHÄSALMI	Located ~100 kms from HITURA. A new location for piloting the cover structure.

1. List of contents

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Annex 13a	RAMFI purchasing guide in Finnish
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Other documents to be submitted:

- Payment Request
- Consolidated Cost Statement for the Project
- Ramfi Individual Cost Statement
- Fortum Individual Cost Statement
- SMaastoRAK Individual Cost Statement
- Ramfi TES (Excel in USB)
- Fortum TES (Excel in USB)
- SMaastoRAK TES (Excel in USB)
- Cost per action (Excel in USB)
- Gantt chart (Excel in USB)

2. Executive Summary

UPACMIC aims to demonstrate the technical and environmental feasibility of structures that are suitable in the mining environment and are made of alternative materials instead of using only virgin natural aggregates, bentonite mattes and geosynthetic geomembranes. The innovations are based on stabilization technology and waste materials mixture development projects used in other infra projects and now the technology is tested for the first time in the mining environment. The intention is to test the technology with three different structures – cover structure, bottom structure and reactive barrier.
The project is expected to promote waste material utilization, reduce the need for commercial oil base products (geomembranes) and to preserve primary aggregates such as gravel and esker formations. Preserving these geological formations from excessive aggregate intake, impacts also on the nearby landscapes, forests, biodiversity and recreation and other nature values.

UPACMIC implements Waste Framework aspects and contributes to the European Union environmental policies with respect to resource efficiency and waste management. UPACMIC will produce at least three practical civil engineering applications (cover, bottom and reactive barrier structures), showing how industrial by-product combinations can be successfully used in mine remediation structures without compromising the overall environmental protection targets. UPACMIC will give information for the European politicians and legislative authorities, mitigating the national and European legislation by addressing the use of secondary aggregates in mine remediation structures. This information is important also for stakeholders working in the field. Project promotes the addition of by-products to “mining industry materials act”, which can promote general utilization possibilities.

Figure 1 present the current conventional strucutures used and the preliminary structures described in the proposal.

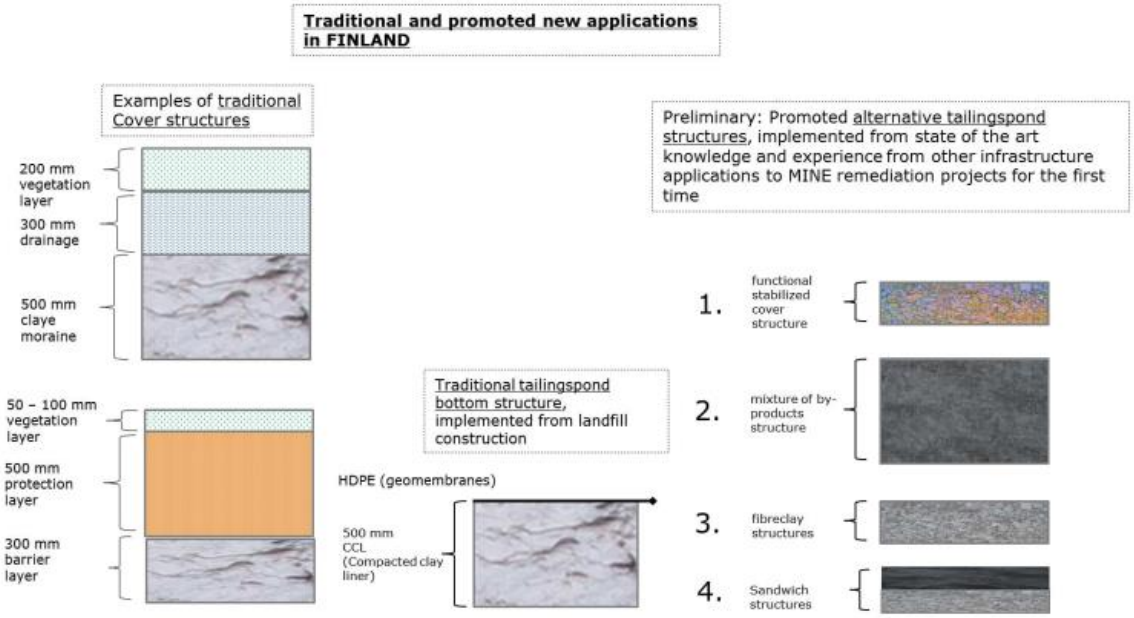

Figure 1. Conventional structures and promoted UPACMIC applications.

The innovative aspects of the project include the design of the proper material mixtures and structure applications for the bottom-, cover- and reactive dam structures for mine remediation site. Material mixtures are designed for specific applications and environmental protection targets. The positive chemical and physical neutralizing and alkaline properties can be used to demonstrate the positive aspects of these materials against the impact on freshwater.

The first round of the Hitura mine material tests was carried out in spring 2014. Based on the results, the most promising material mixtures were selected for the second round of testing which was carried out in summer/early autumn 2014. The tests were performed for two aggregate materials: nickel tailings and moraine with the use of various secondary materials, such as fly ash (fresh and stockpiled), fibre clay, foundry sand, lime, gypsum.

Uncertainties in the world mining markets started to appear quite soon after the project started and associated beneficiary Belvedere had to shut down their operations as the nickel price crashed. This slowed down also the intended UPACMIC actions and finally Belvedere went to bankrupt in 12/2015. As Belvedere offered the project a piloting site (Hitura Mine) for the construction activities and when the piloting site was lost, the project partners have had to actively search for new piloting sites and this has been very laborious.

Due to the bankrupt of Belvedere Mining company, the government has responsibilities to close the mine and this closing construction Fortum has done since autumn 2017 and thus associated beneficiary Fortum started to construct in Hitura Mine as Fortum won the construct which was set up by the authority North Ostrobothnia Centre for Economic Development, Transport and the Environment. At first the cover structure was designed the construct conventionally with the natural aggregates, but the authority accepted the use of fiber clay in the cover structures and for now at least 80 000 tons of natural moraine has been saved in cover structure application.

Cover structure

In 2016 field tests was constructed in the Pyhäsalmi Mine were lysimeters were built (see chapter 5.2.4) with different materials. The purpose of these studies was to examine how the used materials work in real circumstances in the field and to get information for the materials and their mixtures water permeability and leaching properties, and to complement the data that was earlier studied in laboratory circumstances. Also, attention was paid to the material treatment/handling, mixing and compacting properties. The results of these field tests were supposed to use in larger pilot construction activities, which were at this stage thought to take place in the Pyhäsalmi Mine. Although the field tests in the Pyhäsalmi Mine gave a lot of new information, Pyhäsalmi withdrew from the project.

Results from Pyhäsalmi field tests has been yet utilised in nearby Hitura Mine, where the cover structure has been piloted. The pilot construction started in 2017 and originally it was planned to use 0,20 m layer of moraine in the compaction layer and above that 0,1 m layer of soil for landscaping purposes. The design was changed so that the 0,2 m moraine layer was substituted with 0,25 m fiber clay layer (see Figure 2).

Fiber clay structure is technically better structure than moraine structure, as fiber clay has better water permeability which is important for this kind of structure. If fiber clay would not be used for construction purposes, the material would be combusted as it is expensive to storage large amounts of material. Fiber clay though does not have actual proper heat value due to high water content, so the utilization is important from the resource efficiency point of view.

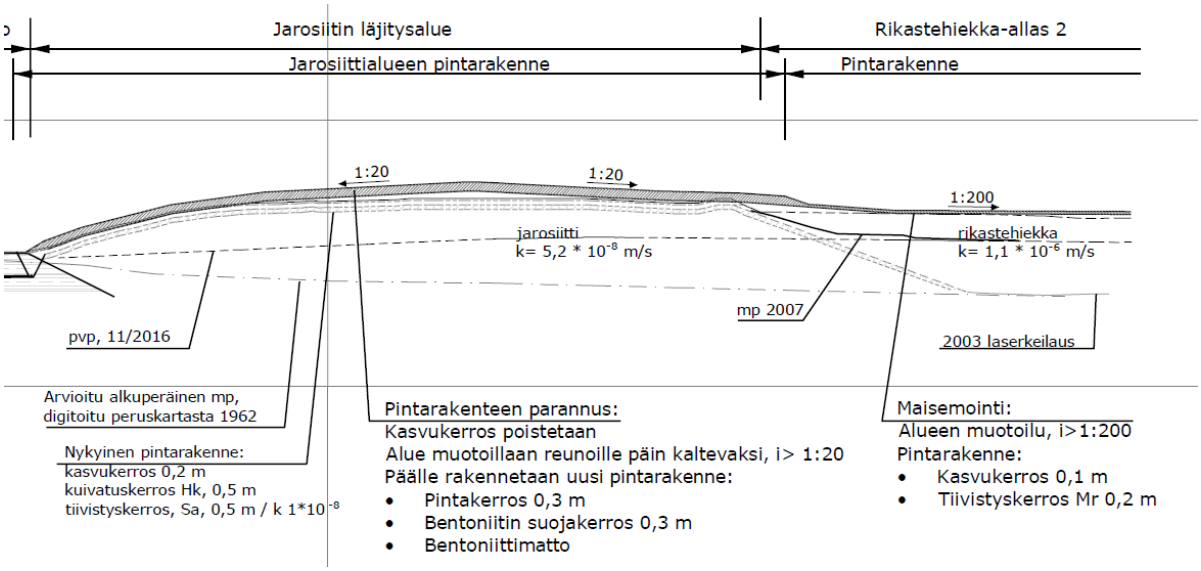

Figure 2. The initial plan to use 0,20 m layer of moraine, which was substituted with 0,25 m fiber clay layer.

According to preliminary calculations, the fiber clay structure has saved ~80 000 tons of natural moraine aggregates. In addition, above the cover structure in the soil layer, industrial secondary materials such as branch waste and decomposition are used, and this also has saved natural soil materials ~5000 m^3. The construction is still ongoing, so the final calculations for environmental and financial benefits are not completed yet, but these preliminary results are the current outputs of the UPACMIC project.

Bottom structure

Bottom structure is not yet piloted but the possibilities for piloting sites are under discussion.

Reactive barrier

Reactive barrier is not yet piloted but the possibilities for piloting sites are under discussion. Preliminary idea of reactive dam structure is presented in Figure 3. The structure has to be tailored depending on the pilot site characteristics.

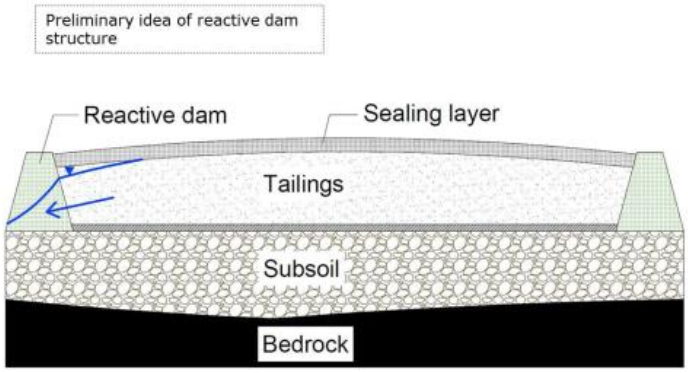

Figure 3. Preliminary plan for reactive dam structure.

Key deliverables in the UPACMIC project this far has been the deliverables to the WASCON2015 and WASCON2018 conferences, including articles, presentations and posters. Posters have also been introduced in seminars and project brochure has been actively shared for participants in the project related events and meetings. More information of dissemination activities are presented in chapter 5.4.

In this Mid-Term report the UPACMIC project is generally presented in the Introduction chapter 3. Administrative part and descriptions of the management activities are presented in chapter 4. Project technical progress is written in chapter 5, as well as dissemination activities. Financial progress is presented in chapter 6.

When writing this report in the end of 2018, an offer has just been sent to Pohjois-Savo Centre of Economic Development, Transport and Environment for the preliminary studies of Särkiniemi Mine in Leppävirta. The intention is to study the utilization of fly ash, gypsum and waste lime in stabilization/neutralizing of acid producing aggregates e.g. in passive water treatment (reactive dam structure) and in the water control/waste rock cover structures. Särkiniemi case is very challenging but we hope UPACMIC project could solve the acidic problems occurring. This needs the acceptance of the offer in order to proceed.

Progress of the UPACMIC project until the reporting day 30/09/2018 has been slow mainly due to difficulties in the mining sector and finally the bankrupt of the associated beneficiary Belvedere Mining (Hitura Mine) in December 2015.

Locations of the UPACMIC beneficiaries and current operations are listed in Figure 4.

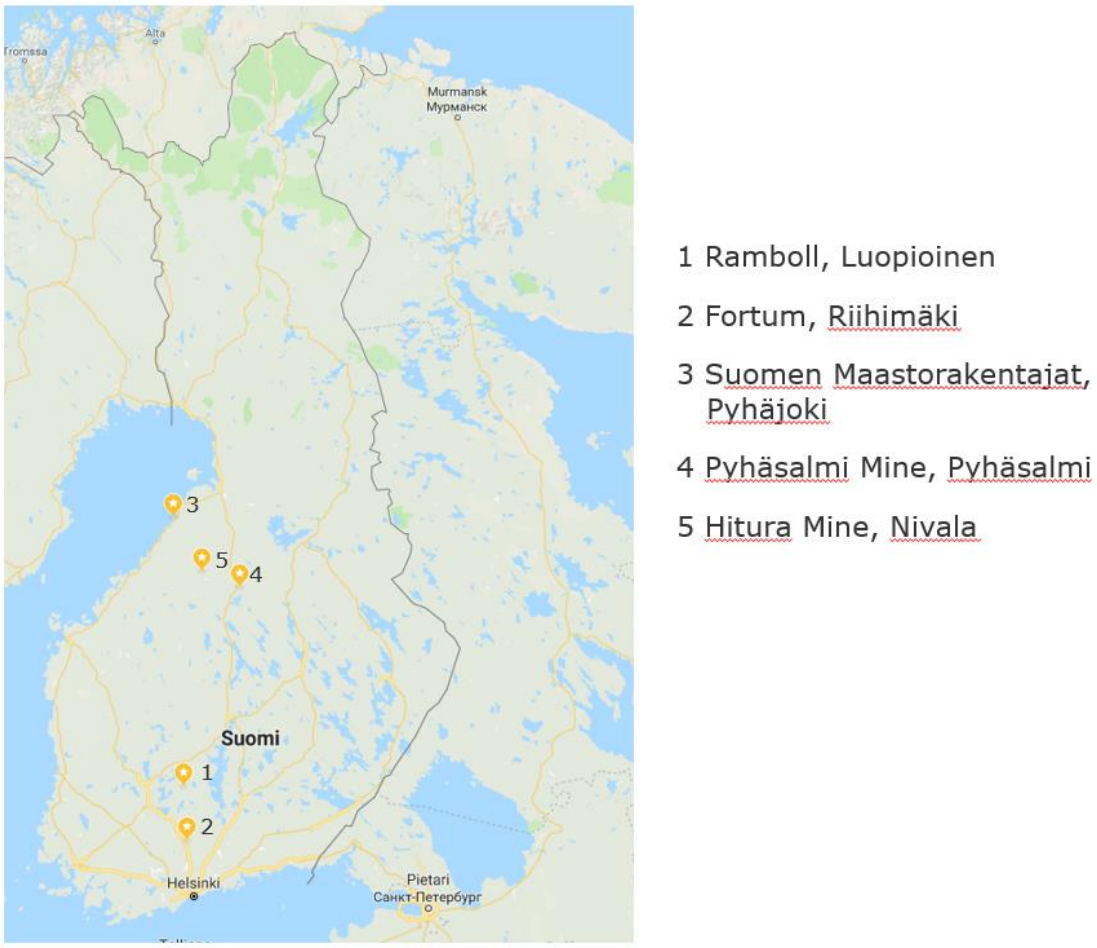

Figure 4. Map of UPACMIC locations.

The project end date is 31/08/2020 after which the Final report and all the other deliverables to be submitted with it are delivered by the three month period at the latest (common provisions article 12.1).

3. Introduction

3.1 Description of background, problem and objectives

When writing the application in 2012, the mining boom had resulted in opening plenty of new mines and resulted into concerns of environmental impacts if the mining technologies. Mining and quarrying waste is a significant source of pollution and general environmental degradation, in particular of freshwater systems. Mining operations also produce more than 400 million tons of waste from the extractive industries each year in the EU and the yearly amount of produced tailings materials is approximately 15-20 million tons. For example, in Finland there were 47 tailings impoundments in 2011 and about 40 mines and quarries, size ranging from 1 ha to 900 ha and volume varying from 10 000 m^3 to 100 000 000 m^3. Remediation of Finnish tailings heaps consumes hundreds of million tons of natural aggregates and enormous amounts of commercial sealing products, together generating huge amounts of greenhouse gas emissions.

UPACMIC aims to demonstrate the technical and environmental feasibility of structures that are suitable in the mining environment and are made of alternative materials instead of using bentonite mattes and geosynthetic geomembranes. The innovations are based on stabilization technology and waste materials mixture development projects used in other infra projects and now the technology is tested for the first time in the mining environment. The intention is to test the technology with three different structures – cover structures, bottom structure and reactive barrier.
The project is expected to promote waste material utilization, reduce the need for commercial oil-based products and to preserve primary aggregates such as gravel and esker formations. Preserving these geological formations from excessive aggregate intake, has also impacts on the formations nearby landscapes, forests, biodiversity and recreation and other nature values.

UPACMIC project is expected to:

- substitute 10 000 tons of CO_2 emissions
- implement central aspects of the Waste Framework directive and contribute to the environmental policies of European Union especially with respect to resource efficiency and waste management
- The project will produce at least three practical civil-engineering applications
- The project will give information for the European politicians and legislative authorities and mitigate the national and European legislation addressing use of secondary aggregates in mine remediation structures.
- Project strives to promote addition of by-products to "mining industry materials act", which would promote general utilization possibilities.

3.2 Expected longer term results

In the longer term (until 2020 - 2030) the secondary aggregates and industrial by-products in the mine construction, will be accepted and become an established practice in the EU, followed by significant reductions in wastes to be landfilled, primary aggregates such as natural eskers and moraine deposits, and commercial sealing products used and other reductions in releases of greenhouse gases as CO_2- eqv.

UPACMIC implements Waste Framework aspects and contributes to the European Union environmental policies with respect to resource efficiency and waste management. UPACMIC will produce at least three practical civil engineering applications (cover, bottom and reactive barrier structures), showing how industrial by-product combinations can be successfully used in mine remediation structures without compromising the overall environmental protection targets. UPACMIC will give information for the European politicians and legislative authorities, mitigating the national and European legislation by addressing the use of secondary aggregates in mine remediation structures. Project promotes the addition of by-products to “mining industry materials act”, which can promote general utilization possibilities.

The list of UPACMIC deliverables and milestones is presented as Annex 1.

4. Administrative part

4.1 Description of the management system

RAMFI as a coordinating beneficiary is main responsible for coordinating the project, organizing the meetings and negotiations with the different stakeholders. RAMFI also actively is in contact with the associated beneficiaries and shares relevant information of project possibilities and in addition, e.g. of suitable seminars and events. RAMFI is the contact link between the project monitors and the Commission when needed. The associated beneficiaries will also promote the project needs whenever it is possible.

UPACMIC project organisation is presented in the organigramme in Figure 5.

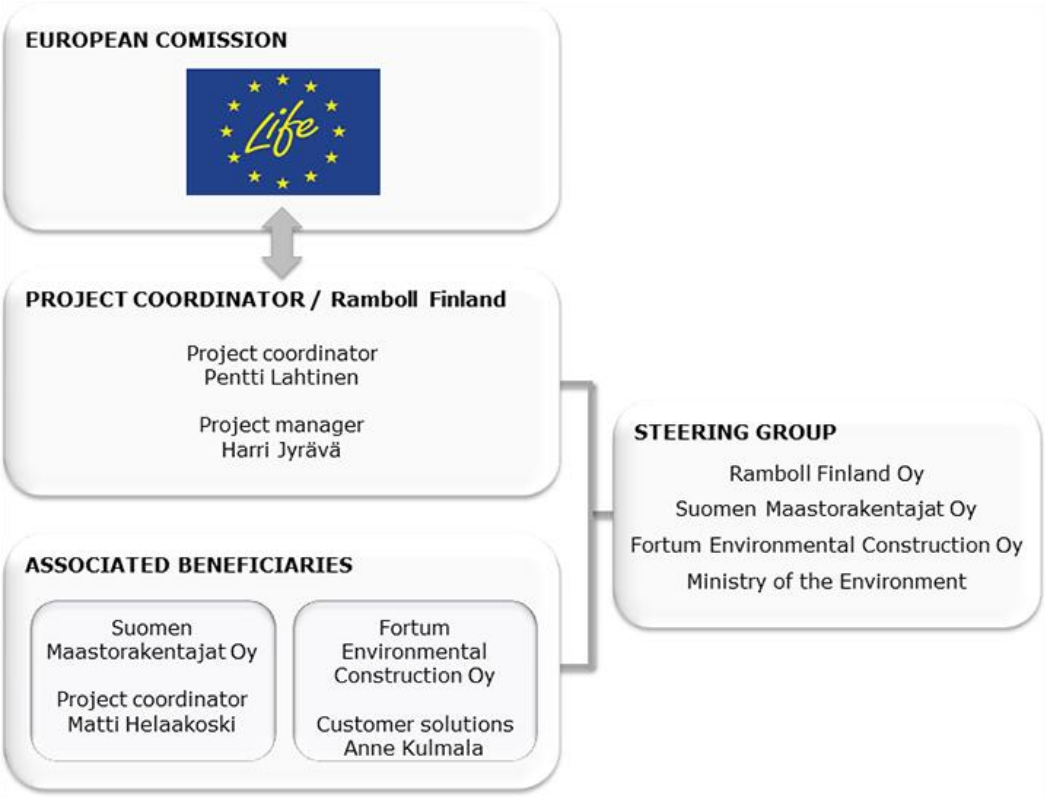

Figure 5. UPACMIC organigramme.

Project key personnel and their tasks in the UPACMIC project are presented in Tables 1,2 and 3.

Table 1. Key personnel in Ramboll for the UPACMIC management

Name	Role in the project	Tasks
Mr Pentti Lahtinen	Coordinator	Coordinating issues, negotiations with the project beneficiaries, project stakeholders, possible clients, etc.
Mr Harri Jyrävä	Project Manager	UPACMIC project management in Ramboll for technical issues, construction design, laboratory studies design, construction

		instructions, etc.
Ms Tarja Niemelin	Project Manager	UPACMIC project management in Ramboll for administrative issues, TES issues, communication with the Commission, reporting, etc.
Ms Laura Hidden	Financial Assistance	Financial assistance in UPACMIC management

Table 2. Key personnel in Suomen Maastorakentajat for the UPACMIC management

Name	Role in the project	Tasks
Mr Matti Helaakoski	Beneficiary contact person, Branch Manager	Negotiations with the project beneficiaries, project stakeholders, possible clients, etc.
Ms Sanna Hälvä	Financial Assistance	TES reporting

Table 3. Key personnel in Fortum for the UPACMIC management

Name	Role in the project	Tasks
Mr Jan Österbacka	Beneficiary contact person	Negotiations with the project beneficiaries, project stakeholders, possible clients, etc.
Ms Anne Kulmala	Beneficiary contact person	TES reporting
Mr Antti Virtanen	Work Manager	Piloting issues at the Hitura site

All the partners (RAMFI, SMaastoRAK and FORTUM) have been cooperating to carry out the piloting activities and to work on the pilot arrangement since the project beginning and especially after the BELVEDERE bankruptcy in 2015. RAMFI has been carrying out various tasks in all the project Actions, especially in material tests and design as well as the management related activities. SMaastoRAK has carried out construction works for preliminary field tests, made in Pyhäsalmi Mine on 2016. FORTUM has carried out construction works in Hitura Mine since autumn 2017.

All the partners remain in a close contact and the partners meet at least once a year face to face in a steering group meeting, which is usually organised in RAMFI office in Espoo or in Tampere. Also, Sirje Stén from Ministry of the Environment has participated in steering group meetings. As Ms Stén is not anymore involved with mining issues, Ms Soile Nieminen representing both the Ministry of the Environment and Pohjois-Savo Centre of Economic Development, Transport and the Environment, is a new member of the steering group since 2018. Project monitor, Ms Katja Lähdesmäki from Neemo, participated also in SG meeting in March 2018. RAMFI as a coordinating beneficiary also meets beneficiaries one-to-one at need. As the beneficiaries are located far from each other, also remote meetings via Skype are organised at need.

Working method in the UPACMIC project is a typical engineer and consulting company method which is based on five project phases; conception, planning, execution, control and project closing. UPACMIC has progressed from the conception and planning phase to execution and control phase as for cover structure. For bottom and reactive dam structure the project is at the planning phase and is waiting for the execution phase (to find the proper piloting sites). See further for Table 4.

Table 4. UPACMIC project phases

Project phase	Activities and tasks	When
Conception	Defining the project tasks and objectives, setting the targets, creating networks	01/2013 -> 12/2014
Planning	Designing the pilot structures, and the needed tests, work instructions, quality control instruction	07/2013 -> ongoing
Execution	Constructing of pilot structures	07/2017 -> ongoing
Control	Quality control of the constructions, reporting	07/2017 -> ongoing
Project close	n/a	2020

UPACMIC project has confronted significant changes two times, which needed amendment requests to the Commission. First amendment was made already in the starting phase in 2014 as two original partners (Lassila-Tikanoja and Hartikainen) withdrew from the project and new partners Fortum (former Ekokem) and Belvedere Mining took their place as associated beneficiaries. The Consortium Agreement embracing the new partners was signed in July 2014 and delivered to the Commission as an Annex to the Amendment Request.

In 2015 Belvedere Mining went to bankrupt and due this the second amendment was needed. This caused Belvedere withdrawal from the project and Belvedere budget was transferred to the coordinating beneficiary's budget. The Amendment with the budget changes and project extension was submitted and approved in 2016.

As explained in chapter 6 Comments on the financial report, we are about to deliver yet one Amendment in spring 2019 due to budget category changes, as it is said in Common Provisions article 15.2. The total budget will not be changed.

4.2 Evaluation of the management system

UPACMIC project has confronted significant changes two times, which needed amendment requests to the Commission. First amendment was made already in the starting phase in 2014 as two original partners (Lassila-Tikanoja and Hartikainen) withdrew from the project and new partners Fortum (former Ekokem) and Belvedere Mining took their place as project beneficiaries. In 2015 Belvedere Mining went to bankrupt and due this the second amendment was needed. This caused Belvedere withdrawal from the project and Belvedere budget was transferred to the coordinating beneficiary's budget. The Amendment with the budget changes and project extension was submitted and approved in 2016. As Belvedere was the beneficiary offering the project a piloting place, this caused significant delays in the project implementation as the other beneficiaries has been forced to find new solutions where the planned applications could be constructed. There have been difficulties to commit the possible piloting sites to the project, as the mining companies are not obligated to participate in the UPACMIC so there can be unexpected turns in the proceedings as has been with the Pyhäsalmi Mine and Orivesi Mine sites, which were first thought to be suitable piloting sites. Also, the schedule (piloting in 2018-2019, perhaps some smaller piloting could take place also in summer 2020) has been too

tight for some companies. Many mining companies have closing duties and they are interested in the UPACMIC methods and materials, but they cannot participate on these actions with the given schedule.

There has also been a change of name due to corporate acquisition, as Fortum bought Ekokem in 2017 and thus the beneficiary Ekokem has changed its name to Fortum. The corporate acquisition did not impact on the registration numbers etc. company identification issues. Also, there will be change within associated beneficiary Fortum, as the company will be merged together with Fortum Waste Solutions Ltd in the beginning of 2019 and this causes a change in company's registration number. This merging will not impact on the implementation of the UPACMIC project but will need an Amendment.

The administrative tasks of the project have been proceeding well. The cooperation among all the project partners has worked well and the project coordinator - Pentti Lahtinen from RAMFI – has been in a frequent contact with all the parties involved. All the partners bring different added value for the project, RAMFI has a long experience on the EU projects and on the use of alternative materials in infra applications. Fortum (Ekokem) is experienced in material processing and construction issues and SMaastoRAK is experienced construction company, and this experiment is highly needed when designing and implementing the applications.

Associated beneficiaries report their costs in 3 months periods (4 times a year) to the coordinating beneficiary, which will be the grounds for the EU contribution. RAMFI will check the TES tables gives the beneficiary permission to invoice the EU contribution based on the three months period costs. Beneficiaries have their own reference number for the invoicing purposes.

RAMFI has been actively in contact with the monitor Ms Katja Lähdesmäki when necessary and Ms Lähdesmäki has been very helpful throughout the project. RAMFI has received feedback from the Commission from the Progress Reports and monitor visits and has actively responded to the feedback as asked. In this report, answers are given for the questions raised in the Progress Report 3 in Annex 2.

In the proposal, the deadlines presented in Table 5 are set. As this current Midterm report will be sent to the Commission by 31/12/2018, we ask new deadlines for the remaining two reports. As Progress report 4 should be reported in few months, it would be more relevant to report the progress by the end of the year 2019.

Table 5. UPACMIC progress reporting deadlines.

Type of report	**Deadline**	**New deadline**
Inception report	31/01/2014	n/a
Progress report (1)	31/10/2014	n/a
Progress report (2)	31/12/2015	n/a
Progress report (3)	30/06/2017	n/a
Midterm report	31/12/2018	n/a
Progress report (4)	**31/03/2019**	**31/12/2019**
Final report	**31/08/2020**	**(30/11/2020*)**

** The project end date is 31/08/2020 after which the Final report and all the other deliverables to be submitted with it are delivered by the three-month period at the latest (common provisions article 12.1). This date 30/11/2020 is also referred in the report and in the Annex 1 Deliverables and Milestones.*

4.3 Project management actions

The progress of the management actions is described in chapters 4.3.1…4.3.4.

4.3.1 E1. Management and Monitoring

Name of activity	Planned deadline	Actual progress
Management and Monitoring	III/2018	III/2020

Name of Deliverable	Deadline	Status
Inception Report (plus: Annex 1, State-of-the Art report: Annex 2, Consortium Agreement)	01/2014	Delivered
Consortium Agreement (from Action A1) is delivered	08/2013	Delivered with the Inception report
Project contact database	08/2018	New planned deadline is 31/12/2019 submitted with 4th Progress Report (see Table 5)
Green Procurement Policy	05/2014	Delivered with the 1st Progress Report
Monitoring Final report (reported with the Final report)	08/2020	New planned deadline is 30/11/2020 submitted with the Final Report
Monitoring report 1 (reported with the 1st Progress report)	10/2014	Delivered with the 1st Progress Report
Monitoring report 2 (reported with the 2nd Progress report)	12/2015	Delivered with the 2nd Progress Report
Monitoring report 3 (reported with the 3rd Progress report)	02/2017	Delivered with the 3rd Progress Report
Monitoring report 4 (reported with the 4th Progress report)	03/2019	New planned deadline is 31/12/2019 submitted with 4th Progress Report (see Table 5)

Milestones name	Deadline	Status
-	-	-

Description of work

The Management Action involves the overall management and co-ordination of the project according to the details of the project plan and the financial budget and with respect to the contract with the Commission. The activities comprise of the project progress monitoring, supplying the Commission with the activity reports (inception, progress, midterm and final reports). The results will be delivered as part of the Final Report. The activity reports (inception report, the progress reports, as well as the midterm report and the final report

with financial statements and payment requests) will be collated by the project manager with the help of RAMFIs staff and other beneficiaries' administration.

Modification of action compared to project proposal
Due to the delays in the piloting actions, we suggest postponing the deadlines of Monitoring Report 4 to be delivered with the 4th Progress Report and Monitoring Final report to be delivered with the Final report. These changes do not have impact on the project objectives, instead their postponing is essential to deliver sufficient details of the project progress.

Problems encountered
This action has taken more work than initially was expected, due to the bankrupt of Belvedere in 12/2015 as we have searched new piloting sites and collaboration partners for the project. This also caused the need to make the Amendment according to the Common Provisions article 15.2.

Indicators of progress:

The Action will be carried out according to the timetable and the planned budget

- Frequency of the project management team meetings - 4 times a year: *project meetings are organized when needed, also via remote channels*
- Frequency of the SG meetings - 2 times a year: *once a year has been found to be sufficient*
- Number of project director in each organisation – 1: 1
- Number of project managers in each organisation – 1: 1
- Number of Monitoring reports – 5: *3 submitted*
- Numerous project workers in all of the organizations of RAMFI, Suomen Maastorakentajat, Belvedere and Ekokem: *there has been numerous project workers involved in the project (Belvedere excluded)*

4.3.2 E2. Networking with other projects

Name of activity	Planned deadline	Actual progress
Networking with other projects	II/2018	II/2020

Name of Deliverable	Deadline	Status
Report: Mapping activities and detailed networking plan (delivered with the inception report)	01/2014	Delivered with the Inception Report.
Report on the networking activities carried out during the project life (delivered with the final report)	08/2020	New planned deadline is 30/11/2020 submitted with the Final Report

Milestones name	Deadline	Status
-	-	-

Description of work

This action includes networking with similar project if they are open for sharing information. The aim of this Action is to establish a proper level of networking with various LIFE and other EU projects to ensure an efficient knowledge and experience transfer in order to foster its replication in similar contexts. This Action will also aim at establishing a UPACMIC network of European stakeholders and target audience.

Networking is mainly done nationally with different stakeholders in order to gather knowledge and to promote the project methods (see chapter 5.4.4). Networking is done also through the national UUMA2/UUMA3 project, that promotes the use of alternative materials in infra construction (www.uusiomaarakentaminen.fi).

In addition, LIFE Hungary Capacity Building project contacted us and made a project visit in October 2016 and mutually invited to share UPACMIC project experiences in training day they organized in May 2017 in Budapest. Ms Tarja Niemelin gave a presentation about the project, its progress and faced difficulties.

Modification of action compared to project proposal
No actual modifications. The Plan will be delivered together with the Final Report which is scheduled to be delivered 11/2020 at the latest (project end 08/2020).

Problems encountered
No problems encountered, only the delays in piloting has slowed to promote the project results, but this will be now improved as we have the preliminary results from the cover structure piloting.

Indicators of progress:

- The Action will be carried out according to the timetable and in the framework of the planned budget.: *delays in the piloting will prolong also this action until 2020.*
- The Action will map and update mapping of the projects once a year.: *Will be done on a yearly basis*
- Number of EU LIFE projects networking during the project life time (2013-2018) – 10: *several projects already contacted but networking action will be now improved as the cover structure preliminary results are available*
- Number of Skype conferences – 5: *2 skype meetings held with the Swedish company Ecoloop on networking issues and use of green liquor dreg in the mining construction*
- Number of reports – 2: *1 report submitted with the Inception report*

4.3.3 E3. After-Life communication plan

Name of activity	Planned deadline	Actual progress
After-Life communication plan	III/2020	III/2020

Name of Deliverable	Deadline	Status
After-Life Communication plan (delivered with the final report)	08/2020	New planned deadline is 30/11/2020 submitted with the Final Report

Milestones name	Deadline	Status
-	-	-

Description of work

RAMFI in cooperation with the other partners will produce an "After-LIFE Communication Plan" as a separate chapter of the final report. It will be presented in Finnish and in English, and available both in paper and electronic format. The aim of the plan will be to design the best ways of sustaining UPACMIC impact on the stakeholders and the target audience after the actual end of the LIFE project. The creation of this document will take place in the end of the UPACMIC project and will strongly rely on the findings and lessons learned from the dissemination actions. Also, the future workshops, conferences and other events both on national and international level will be mapped, as they can act as forums for further dissemination of the project results. The project stakeholders and the members of the network will be contacted and asked for feedback and proposals for the future. Also, an analysis of the potential future projects that could be developed with the help of the project network, will be done.

This action is not yet progressed as it is part of the final years tasks.

Modification of action compared to project proposal
No actual modifications. The Plan will be delivered together with the Final Report which is scheduled to be delivered 11/2020 at the latest (project end 08/2020).

Problems encountered
No problems encountered.

Indicators of progress:
- Number of Communication plans which will be followed – 1: *communication plan has to be updated*
- Beneficiaries Ramboll, EKOKEM, Belvedere and Suomen Maastorakentajat are in active communication to create an After-Life communication plan.: *The communication plan creation starts later in the project.*

4.3.4 E4. External audit

Name of activity	Planned deadline	Actual progress
External audit	IV/2020	III/2020

Name of Deliverable	Deadline	Status
The independent audit of the final financial report (delivered with the final report)	08/2020	New planned deadline is 30/11/2020 submitted with the Final Report

Milestones name	Deadline	Status
-	-	-

Description of work

This Action will enable the Commission the verification of the financial statements included in the project's final report. This audit will ensure that with respect to national legislation and accounting rules all costs incurred follow the stipulations of the LIFE+ Common Provisions. This independent auditing of the projects final financial report will be done in the end part of EU Life+ financing. The cost of external assistance will be shared evenly with associated beneficiaries.

We have conducted a midterm audit per 31.12.2016 costs. This will help the final audit as the first years of the project has been audited. There were no major problems encountered and the auditor Ms Sari Pohja from PricewaterhouseCoopers Oy discussed separately with each beneficiary on the notes she made (see chapter 6.4).

Modification of action compared to project proposal
No actual modifications. The Plan will be delivered together with the Final Report which is scheduled to be delivered 11/2020 at the latest (project end 08/2020).

We will add budget for this action in the Amendment as we have earlier explained, as we have underestimated the audit costs in the proposal stage.

Problems encountered
No problems encountered.

Indicators of progress:
This action is accomplished when the audit report is delivered. One key progress of this action is the confirmation of payment to the auditing company, which starts the practical auditing.
- Number of financial auditing reports created – 1: *n/a, will be done later in the project*

5. Technical part

5.1 Preparatory actions

5.1.1 A1. Signing Consortium Agreement and Steering Group Launch

Name of activity	Planned deadline	Actual progress
Signing Consortium Agreement and Steering Group launch	III 2013	Action completed. The Consortium Agreement embracing the new partners was signed in July 2014 and delivered to the Commission as an Annex to the Amendment Request.

Name of Deliverable	Deadline	Status
-	-	-

Milestones name	Deadline	Status

The consortium agreement signed, and the steering-, expanded steering and piloting group launched	08/2013	Action completed. The Consortium Agreement embracing the new partners was signed in July 2014 and delivered to the Commission as an Annex to the Amendment Request.

Description of work done
Action completed. The Consortium Agreement embracing the new partners was signed in July 2014 and delivered to the Commission as an Annex to the Amendment Request.

Modification of action compared to project proposal
No modifications.

Problems encountered
Change of the initial partners when Hartikainen and Lassila-Tikanoja withdrew from the project. Suomen Maastorakentajat and Fortum (former Ekokem) took their place as new associated beneficiaries.

Indicators according, current situation:

- Number of groups organized: 0 *(this has not seen necessary after the project started, as partners are actively in communication with together)*
- Number of Consortium agreements written: *1 agreement; signed by all the project beneficiaries and delivered to the Commission. After project partner changes, new Consortium agreement was delivered to the Commission as an Annex of to the Amendment request.*
- Active participation like phoning and e-mailing will be calculated, as an indicator of positive spirit: *Impossible to count as there has been numerous phone calls and e-mail concerning the project implementation and possibilities.*

5.1.2 A2. Plans for Preliminary Materials and Methods and Equipment Development

Name of activity	Planned deadline	Actual progress
Plans for Preliminary Materials and Methods and Equipment Development	IV 2016	II/2019

Name of Deliverable	Deadline	Status
State-of-art report – equipment development	10/2017	Will not be implemented
State-of-art report for (preliminary materials, methods)	03/2014	Delivered with the Inception Report.
Written instructions for the equipment development and mixing procedures	10/2017	Will not be implemented

Milestones name	Deadline	Status
Preliminary development planning done and finished (so that operative work only remains)	09/2013	Completed for flow column device -> did not seem necessary. (Instead purchase of tap milling device, see chapter 5.2.4)

Description of work done

The overall objective with action A2 was to prepare a fluent start for the project implementation. In this action the target applications have been determined, the availability of the relevant materials and their locations has been studied and preliminary plans has been done. This action also has included the definition of technical, environmental and economic criteria for materials and applications. Action is almost completed as the application details and confirmation of the material types used in the pilot has been done for the cover structure. The bottom structure and reactive dam strucutres and their piloting location are not yet confirmed which have influence on the materials to be used.

Modification of action compared to project proposal

Unfortunately, deliverables concerning the equipment development will not be implemented as it seems that equipment development is not happening in the project. The actual equipment budgets are categorised for action A4 and will need amendment for the budget (foreseen in spring 2019).

We see that this does not harm the project objectives, instead we think it is better that we have been able to start piloting without special equipment as this will also ease the replication and transferability of the project methods. See also chapter 5.2.4.

Problems encountered

As described above, equipment development will not be implemented in the project. The lack of equipment development is highly due to the bankrupt of Belvedere as this caused significant delay and uncertainty for the coming applications and piloting sites. And as the project is due to end in August 2020, there is no time for the partners to benefit from the cost depreciations. This has not yet been agreed with the EC.

The lack of equipment development is further discussed in chapter 5.2.4 Applications.

Indicators compared with the project proposal

- Successful preliminary plan for laboratory prototype (flow column device to depict realistic natural conditions in laboratory) – 1: *0 no plans for flow column devices as this was finally seen unnecessary*
- Equipment development entities depicted (pictures, technical details, purchase planning done), so that efficient designing can be started in implementation action – 1: *0 this is not going to happen in the project due to the delay of piloting activities*
- Preliminary illustrations of piloting applications for barrier and dam structures – 1: *1*

5.1.3 A3. Materials

Name of activity	Planned deadline	Actual progress
Materials	IV/2015	IV/2019

Name of Deliverable	Deadline	Status
Final technical report (compiling all the activities and results of the materials action during the project years 2013 - 2019)	10/2017	The Action is still on going so the report will be finalized when we have compiled all the material actions from all the piloting structures. New planned deadline is 30/11/2020 submitted with the Final Report.
Material matrix for mining operations	06/2017	This deliverable still is under work as all the piloting structures are not designed yet. New planned deadline is 30/11/2019 submitted with the 4th Progress Report.

Milestones name	Deadline	Status
Material studies made for the bottom structure	06/2017	Material studies for bottom structure are not completed as the piloting site is not yet decided. New planned deadline is 31/12/2019.
Material studies made for the cover and reactive dam structure	06/2017	Cover structure studies are ready but the reactive dam structure studies are not yet started. New planned deadline is 31/12/2019.

Description of work done

To determine what secondary materials would be the most suitable for the purpose of the project pilot applications, geotechnical and environmental tests for the tailings and combinations of various materials has been tested.

The first round of the Hitura mine material tests was carried out in spring 2014. Based on the results, the most promising material mixtures were selected for the second round of testing which was carried out in summer/early autumn 2014. The tests were performed for two aggregate materials: nickel tailings and moraine with the use of various secondary materials, such as fly ash (fresh and stockpiled), fibre clay, foundry sand, lime, gypsum.

Ramboll has studied Pyhäsalmi materials and the results were updated in July 2015.

This action will continue as the bottom structure and reactive barrier structure is yet under development.

Modification of action compared to project proposal

We must postpone the deadlines of deliverables and milestones as the piloting has delayed. The delays are not foreseen to impact on the project objectives.

Problems encountered

No actual problems within the materials actions other than general delay of the whole project.

Indicators compared with the project proposal

- Saving of the 500 000 tonnes of virgin materials that would be otherwise used for the construction of the cover and bottom structure of the tailings facilities: *The piloting for cover structure in Hitura is still going on so the final amounts of the utilised alternative materials are not yet calculated, but currently 80 000 tons of natural moraine has been saved in cover structure application. Bottom structure and reactive dam are not piloted yet.*
- The avoidance of the use of about 180 ha of bentonite matt cover: *The piloting for cover structure in Hitura is still going on so the final amounts of the utilised alternative materials are not yet calculated. Also bottom structure and reactive dam are not piloted yet.*
- The amount of total material mixtures tested and acceptable found, will be calculated. The quantification of material mixtures tested will be impossible at the moment, since quantification depends on the material components selected for the testing. The test methods used for quantifying the applicability will be based on strength testing of materials. - Finally 3 - 4 suitable recipes will be found.: *Unfinished at the moment.*
- Number of total material reciping entities – 3: *Unfinished at the moment.*
- Number of material matrix documents – 1: *Unfinished at the moment.*
- The progress will be advancing as long as new recipes are tested in the laboratory. When piloting starts and if quality control procedures reveal that material needs improvement, then more materials studied will be needed. The progress will be indicated by recipes studied in relation to recipes being studied in total (this is impossible to know). The final results will be disseminated in the final technical report which comprises the information found in this action.: *Project has progressed as the cover structure is piloted in Hitura.*
- Number of technical reports – 1: *Unfinished at the moment.*

5.2.4 A4. Applications

Name of activity	Planned deadline	Actual progress
Applications	II/2015	I/2020

Name of Deliverable	Deadline	Status
Final report on Applications / Designs; bottom-, cover and dam structures and reactive dam	06/2017	Action is still going on. New planned deadline is 30/11/2020 submitted with the Final Report.
Plans for the reactive wall / Written instructions of work methods, preliminary quality control and pilot follow-up activities	06/2017	Reactive wall structure is yet not started as we are looking for a suitable piloting site. An offer is sent to Pohjois-Savo Centre for Economic Development, Transport and the Environment and we are

		waiting for their decision on the offer. New planned deadline is 31/05/2019.
Final technical report on the equipment development – A) single unit/multifeeder system, B) auxillary spreading device, C) flow-column setting prototype (delivered with the 2nd Progress Report)	10/2017	Will not be implemented.
Plans for the bottom structures of the tailings pond / Written instructions of work methods, preliminary quality control and pilot follow-up activities	10/2014	Bottom structure plans are not ready yet as we are looking for a suitable piloting site. New planned deadline is 31/12/2019.
Plans for the cover of the tailings pond / Written instructions of work methods, preliminary quality control and pilot follow-up activities	10/2014	Completed and attached as Annex 3.

Milestones name	Deadline	Status
-	-	-

Description of work done

The aim of the Applications Action is to produce plans and instructions necessary to enable the implementation of the Piloting Action. As set in the project application, the structures to be tested and demonstrated in the framework of the UPACMIC include the following:

- a bottom structure of a tailings storage facility (it was mentioned in the Progress report 3 that bottom structure would be piloted in Orivesi Mine, but reasons that UPACMIC or its partners cannot impact, this piloting is now excluded, and we are searching for another piloting site for the bottom structure),
- a cover structure of a tailings storage facility (piloting in Hitura Mine. In the Progress Report 3 it was mentioned that piloting of the cover structure would take place in Pyhäsalmi Mine, but this will be implemented in Hitura by Fortum),
- a reactive dam for a tailings storage facility (no piloting location yet, an offer is sent to Pohjois-Savo Centre of Economic Development, Transport and the Environment).

The design for the trial fields of Hitura was completed in June 2014 and it was updated for Hitura materials in May 2015 and for Pyhäsalmi materials in November 2015 to accommodate also testing of the aggregate material from the Pyhäsalmi Mine. Applications were tested in Pyhäsalmi field tests in 2016 (Figure 6).

Fortum has made plans for the cover structure to Hitura mine and the report is attached in the report as Annex 3.

As written in the Progress Report 3, there have also been changes in the intended flow-column setting device. One version of the device was made, but in practice the structures

were decided to test in bigger scale with the help of lysimeters in the Pyhäsalmi mine. The need for column device is not excluded, as that kind of testing is possibly needed especially for reactive dam structures but at the moment activities concerning this flow column device is not going on.

Fine enrichment sand compacted in the lysimeter vessel.

Gypsum and moraine mixed and compacted in the lysimeter vessel.

Enrichment sand + 10 % ash mixed and compacted in the lysimeter vessel.

Lysimeters

Figure 6. Field tests in Pyhäsalmi mine in 2016.

Instead of column device a laboratory scale grinding mill (Figure 7) was purchased for the utilization to increase material reactivity and further for their utilization properties. The materials are grinded with the help of grinders moving in the opposite directions. These tests aim to have impact on the quality of ashes to be utilized and thus find better processing solutions for the structure alternatives.

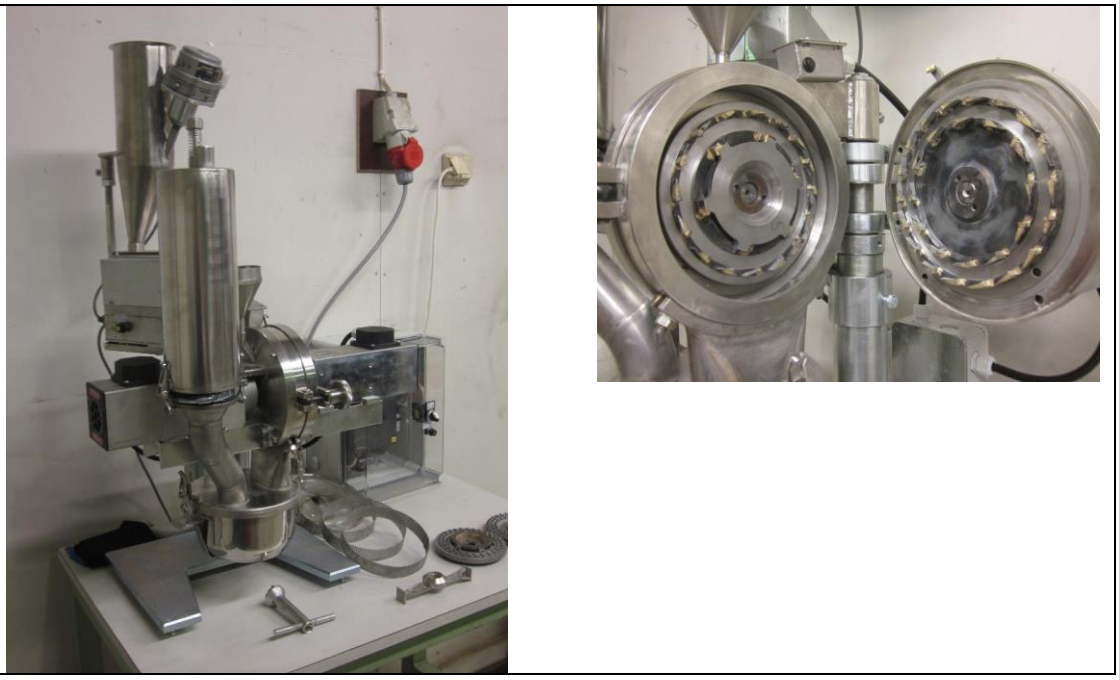

Figure 7. Grinding mill

Modification of action compared to project proposal

The purchase of the grinding mill was discussed with the monitor Ms Katja Lähdesmäki as we wanted to be sure that the purchase was ok. There was no over-spending of the foreseen budget due to the purchase, only the intended flow-column device has not been developed as it was finally seen unnecessary for the project purposes.
In the steering group meeting the possible change of budget categories was discussed as it has come to evident that the equipment development cannot be implemented within the project duration. This has not yet been further discussed with the Commision, but the realistic situation was discussed thoroughly with the monitor Ms Katja Lähdesmäki and she did not see any obstacles that would prevent the changes between the budget categories (although Amendment is needed).

We must postpone the deadlines of deliverables as the search of pilot sites for bottom and reactive dam structures is still going on. The delays are not foreseen to impact on the project objectives but the delays impact on the deadlines significantly because we cannot produce information before we have collected enough data. That's why the deadlines of these deliverables are postponed being submitted with the Final Report in order to produce good quality data and reports.
Actions A4 and B1 go now quite parallel, as although the cover structure piloting is almost done, we still have to work with two other structures, finding a pilot site and also to define the certain characteristics when the pilot site(s) has been found.

Problems encountered

As previously discussed, the bankrupt of the associated beneficiary Belvedere Mining who offered the project the piloting site impacted negatively on the project progress by delaying it and as there has been severe uncertainty on the piloting sites for the piloting structures, the associated beneficiaries have not seen it appropriate to start the equipment development if there is no actual use for them.

Instead, the applications are designed in such way that they can be constructed with the current and existing equipment which will ease the replication and introduction of the methods later within Europe as special and costly modifications are not needed.

Indicators of progress:

- Plans for 3 pilot applications will be ready and allow for the start of piloting action (B1) - number of plans 3: *Cover structure plans completed (1), plans for the bottom structure (1) and reactive dam (1) yet unfinished*
- Because of the applications plans 500 000 tonnes of virgin materials that would be otherwise used for the construction of the cover and bottom structure of the tailings facilities will be saved and replaced by secondary materials: *The piloting for cover structure in Hitura is still going on so the final amounts of the utilised alternative materials are not yet calculated. Also bottom structure and reactive dam are not piloted yet. Currently the savings in natural aggregate use is approximately 80 000 tons.*
- The action will allow for the avoidance of the use of about 180 ha of bentonite matt cover: *The piloting for cover structure in Hitura is still going on so the final amounts of the utilised alternative materials are not yet calculated. Also bottom structure and reactive dam are not piloted yet.*
- The application plans will allow for the overall replacement of the virgin materials in the 3 pilot applications reaching 70%: *as the plans for the bottom structure and reactive dam are not completed, this figure cannot be calculated at this stage of the project*
- Number of Technical Reports – 3: *will be submitted by the end of the project*
- Number of Information Reports (Work specifications) - 1
- Number of laboratory prototypes developed – 1: → 0
- Number of Equipment entities developed – 2: → 0

5.2 Implementation actions

5.2.1 B1. Piloting

Name of activity	Planned deadline	Actual progress
Piloting	II/2018	II/2020

Name of Deliverable	Deadline	Status
Technical report, piloting bottom structure	10/2018	Not started yet. New planned deadline is 30/11/2020 submitted with the Final Report. Please see the text in Modification of action compared to project proposal
Technical report, piloting cover structure	11/2017	In progress. New planned deadline is 30/11/2020 submitted with the Final Report. Please see the text in Modification of action compared to project proposal

Technical report, piloting reactive dam structure (delivered with the Midterm report)	12/2018	Not started yet. New planned deadline is 30/11/2020 submitted with the Final Report. Please see the text in Modification of action compared to project proposal
Final technical report on piloting (delivered with the 4th Progress Report)	03/2019	New planned deadline is 30/11/2020 submitted with the Final Report. Please see the text in Modification of action compared to project proposal

Milestones name	Deadline	Status
Start of piloting action	04/2014	Piloting has started in the Hitura Mine 10/2017.
All practical piloting completed	10/2019	Bottom structure and reactive dam structure are not started yet. New foreseen date is 31/08/2020.

Description of work done

The aim of the Piloting Action is to demonstrate the practical implementation of sustainable and eco-efficient mine construction processes based on secondary materials.

As explained in the previous Progress Reports and in chapter 4.2 in this Mid-Term Report, bankrupt of Belvedere in 2015 caused severe delays in the piloting action as UPACMIC lost the piloting site and the project has actively searched new piloting site(s) for the intended applications.

Despite the setback, the cover structure has been piloted in Hitura (Figure 8), as the mine has obligations to close the mining area and Fortum won the construction tender. The work is ordered by the North Ostrobothnia Centre of Economic Development, Transport and Environment that also has been a supervising authority for the Hitura Mine during its operation time.

Levelled enrichment sand before covering it with fibre clay

Levelled enrichment sand

Fibre clay

Covered enrichment sand (with fibre clay)

Figure 8. Piloting activities in Hitura mine in 2018.

It is expected that the pilot demonstration works will continue until 2019 as we are still in searching the piloting areas for bottom structure and reactive dam structure. When writing this report in the end of 2018, an offer has just been sent to Pohjois-Savo Centre of Economic Development, Transport and Environment for the preliminary studies of Särkiniemi Mine in Leppävirta. The intention is to study the utilization of fly ash, gypsum and waste lime in stabilization/neutralizing of acid producing aggregates e.g. in passive water treatment (reactive dam structure) and in the water control/waste rock cover structures. Särkiniemi case is very challenging but we hope UPACMIC project could solve the acidic problems occurring. This needs the acceptance of the offer in order to proceed.

Modification of action compared to project proposal

Initially it was planned to produce four deliverables as following:

- Technical report, piloting bottom structure
- Technical report, piloting cover structure
- Technical report, piloting reactive dam structure (delivered with the Midterm report)
- Final technical report on piloting (delivered with the 4th Progress Report)

We suggest combining all these reports to one final technical piloting report (submitted with the Final Report) as this would serve best for the project dissemination purposes. The intended separate reports on different pilot structures have similarities and issues to be studied together, so it is not reasonable to separate the reports. This was not foreseen when writing the proposal. Combining of the deliverables do not have impacts on the project progressing, implementation nor financial matters – instead the report combining all the mentioned structures and related issues will produce deeper information and the project results are easier to disseminate.

Problems encountered

As previously discussed, the bankrupt of the associated beneficiary Belvedere Mining who offered the project the piloting site impacted negatively on the project progress by delaying it and as there has been severe uncertainty on the piloting sites for the piloting structures. The cover structure is now implemented in Hitura Mine but the pilot sites for bottom structure and reactive dam are not confirmed yet. The delay in the progress has caused also increase in the management budget (action E1) which is further discussed in chapter 6.1.

Indicators of progress, current situation:

- Implementation of the action according to the planned timetable, list of milestones and deliverables, and the budget framework.: *Despite the delays in the project, the project has progressed as the cover structure piloting has started.*
- Total area constructed, the amount of test fields constructed (percentage of total area piloted). The demonstration site will have a specific area/size. The finished construction will be compared to total area and a percentage point of finished structure, will be given. The exact area of construction will depend on various things, material recipes, - transportation, - overall economic,- environmental permitting. The different possible work methods and the verification (meaning testing on field) will reveal how many valid working methods exists for these materials.: *These indicators seem irrelevant now, as there are more important issues to be investigated than the indicators listed here. For example, what kind of structure and what kind of results can be achieved.*
- Calculation of new discovered working methods, tested working methods and new ideas for improvement. Tested working methods will be categorized for different materials as (rejected, suitable for certain materials and structures): *n/a*
- Number of piloting sites - 1 site: *probably 3 piloting sites, 1 for each structure*
- Number of clear piloting entities - *3 (bottom, cover, reactive wall)*
- Number of Technical Reports – 4: → *1 final technical report suggested*

5.2.2 B2. Logistical Model

Name of activity	Planned deadline	Actual progress
Logistical Model	III/2016	III/2020

Name of Deliverable	Deadline	Status
Final technical report on the MSCD-model (logistical model for utilisation of by-products in mine remediation)	09/2017	Action is still ongoing and due to the piloting timetable changes, the final report on the MSCD-model will be updated when the reactive dam and bottom structure materials are also studied. New planned deadline is 30/11/2020 submitted with the Final Report.
Technical recommendations document	09/2017	Action is still ongoing and due to the piloting timetable changes, the New planned deadline is 30/11/2020 submitted with the Final Report.

Milestones name	Deadline	Status
The MSCD-model for mining industry finished, and all aspects reported	09/2017	Due to the piloting timetable changes, the New planned deadline is 30/11/2020 as the Final MSCD-model report will be submitted with the

		Final report as suggested above.

Description of work done
The foundation for creating the Logistical Model has been laid by creating a network of wastes as secondary materials producers to be involved in the UPACMIC project as material suppliers as reported in the Inception Report. The preliminary report on the logistical issues concerning material locations, distances to the pilot site and prices was compiled in May 2014. In general, all experience gathered while carrying out the material testing, pilot design and construction will be utilised for the needs of this Action.

Modification of action compared to project proposal
We must postpone the deadlines of deliverables as the search of pilot sites for bottom and reactive dam structures is still going on. The delays are not foreseen to impact on the project objectives but the delays impact on the deadlines significantly because we cannot produce information before we have collected enough data. That's why the deadlines of these deliverables are postponed being submitted with the Final Report in order to produce good quality data and reports. This will also impact on the deadline of the Milestone as listed above.

Problems encountered
As the implementation of the actual piloting is delayed, the Logistical Model action is delayed, too. Piloting results will serve also this action.

Indicators of progress:
- Material supply chain development model developed – 1: *to be developed later in the project when also the bottom and reactive dam structures are progressed further*
- Number of stakeholders involved in the action – 10: *the number of stakeholders is foreseen to be as presented*
- Number of technical reports – 1: *to be submitted later in the project*

5.2.3 B3. Quality Control and Verification

Name of activity	Planned deadline	Actual progress
Quality Control and Verification	II/2017	III/2020

Name of Deliverable	Deadline	Status
Final report – Quality control, summarizing report	12/2019	In progress for the cover structure. New planned deadline (to cover also bottom structure and reactive dam structure) is 30/11/2020 submitted with the Final Report.

Milestones name	Deadline	Status
Start of the quality control in	06/2014	QC activities has started in

piloting site		Hitura site.

Description of work
The design concerning the quality control system for the pilot applications has been carried out and the plan was submitted with the Progress Report 1. The launch of this Action has been delayed because of delays in actual piloting. Fortum has started quality control activities in Hitura mine where the cover structure is constructed but the construction works are still in progress. Bottom structure and reactive dam structure are not yet constructed so also quality control for these are started.

Modification of action compared to project proposal
We must postpone the deadlines of the deliverable as the search of pilot sites for bottom and reactive dam structures is still going on.

Problems encountered
As the implementation of the actual piloting is delayed, the Quality Control and Verification action is delayed, too. Activities of this action are synchronized with the Piloting Action B1.

Indicators of progress:

- The quality control methods (such as the density of the compacted material will be compared to values indicated by laboratory tests). A percentage point will be given for those quality control measurements that will pass the laboratory test stage created limit values.: *Percentage is not a relevant indicator for this. The indicators will be modified as the project is progressing and depends on the application to be piloted.*
- Number of sand- and water volymetric, or radiation-based measurements done - This varies on the amount f materials selected for constructing - Approximately 50 - 200 measurements: *The indicators will be modified as the project is progressing and depends on the application to be piloted.*
- Accepted framework for quality control management system for by-product mixtures in mine remediation sites – 1

5.3 Monitoring of the impact of project actions

5.3.1 C1. Monitoring of the Impact on the Target Audience

Name of activity	Planned deadline	Actual progress
Monitoring of the impact on the target audience	II/2018	III/2020

Name of Deliverable	Deadline	Status
Baseline report – KAP Survey method, placed on the project website	01/2014	Submitted with the Inception report.
Result report – KAP Survey results, “Project Ending” /	01/2020	n/a

"Final results" (annex with the Final report)		
Final results report – KAP Survey results, "Project Ending" / "Final results" (annex with the Final report)	01/2020	Will not be implemented: This must be an error in the Deliverables list as this is repeating the previous one. This shall be deleted as unnecessary.
Result report – KAP Survey results, "Project Start" / "Beginning Situation"	12/2014	Submitted with the Progress Report 1.

Milestones name	Deadline	Status
-	-	-

Description of work
The baseline study started with a review of the situation in the waste and secondary materials in Finland as compared to some other countries, as well as with a review of the current situation in the secondary materials' sector. The KAP (knowledge, attitude, practices) questionnaire was placed at the project website. The preliminary results of the Action were presented in the Inception Report. The link to the questionnaire was distributed to selected respondents.

Modification of action compared to project proposal
As described in the table of deliverables, there has occurred an error when listing the deliverables and the "Final results report – KAP Survey results, "Project Ending" / "Final results" (annex with the Final report) " is duplicate of the report "Result report – KAP Survey results, "Project Ending" / "Final results" (annex with the Final report)" and thus the first report mentioned shall be deleted in order to rationalize the deliverables.

Problems encountered
No problems encountered other than the general project delay.

Indicators of progress:

- Action carried out according to the timetable and within the frames of the planned budget
- Number of KAP questionnaires carried out and analysed - 2
- Number of KAP questionnaires recipients each time - 750
- Number of Baseline reports - 1
- Number of Action reports - 1 (only final report)
- Number of Focus Group meetings (arranged together with workshops or other seminars) - 3
- Number of event satisfaction questionnaires – 3: the actual number is most probably 1, after the project final seminar.

➔ *These indicators will be checked when the project has progressed, and it can be better studied which indicators are relevant.*

5.3.2 C2. Monitoring of the Project Actions Impact on the Environmental Problem Targeted and Assessment of the Socio-economic Impact

Name of activity	Planned deadline	Actual progress
Monitoring of the Project Actions Impact on the Environmental Problem Targeted and Assessment of the Socio-economic Impact	II/2018	III/2020

Name of Deliverable	Deadline	Status
Final Verification report (includes LCC/LCA + external review, delivered with the final report)	03/2020	Started for the cover structure. New planned deadline is 30/11/2020 submitted with the Final Report.
Carbon Footprint report 1 (Annex with 1st Progress report)	10/2014	Ready and delivered with the 1st Progress report
Carbon Footprint report 2 (Annex with 2nd Progress report)	12/2015	Ready and delivered with the 2nd Progress report
Carbon Footprint report 3 (Annex with 3rd Progress report)	02/2017	Ready and delivered with the 3rd Progress report
Carbon Footprint report 4 (Annex with 4th Progress report)	03/2019	New planned deadline is 31/12/2019 with the 4th Progress Report (see Table 5)
Eco-efficiency report (published in webpage and reported as an Annex with the 4th Progress report)	03/2019	Will not be implemented: This report is seen unnecessary as the verification report has the same aspects. Thus we suggest to delete this deliverable.
Analysis of the socio-economic effects of the project (delivered with the final report)	08/2020	New planned deadline is 30/11/2020 submitted with the Final Report.

Milestones name	Deadline	Status
Carbon footprint counting instructions delivered to the partners	08/2013	Completed.

Description of work

This Action includes the streamlined LCA (Life Cycle Assessment) and LCC (Life Cycle Cost) studies. LCA/LCC studies provide a proof that use of the project methods and procedures results in a more favourable impact on the environment. The verification results will include also statements of the external experts.

Streamlined LCA calculations for cover structure can be gradually started as the cover structure construction has progressed.

Modification of action compared to project proposal
As described in the table of deliverables, the report "Eco-efficiency report (published in webpage and reported as an Annex with the 4th Progress report)" is foreseen unnecessary and we suggest removing this deliverable. Eco-efficiency issues will be discussed in the Final Verification Report more thoroughly which will also serve the needs of decision-makers and authorities. Eco-efficiency will be dealt also on a general level in Layman's Report.

Problems encountered
No problems encountered other than the general project delay.

Indicators of progress:

- The Action will be carried out according to the timetable and in the budget framework.
- Number of the preliminary study version - 1
- Minimal number of events where preliminary results presented - 4
- Number of experts commented the study – 2: *will be commented later when the verification study and socio-economic studies are finished*
- Number of Eco-efficiency reports – 1:
- Number of recipients of the Report link – 1500: *will be tracked later when the reports are finalized*
- Number of Carbon Footprint reports – 5: *3/5 reports submitted*

5.4 Dissemination actions

5.4.1 D1. Presentation Materials, Layman´s report, Media work

Name of activity	Planned deadline	Actual progress
Presentation Materials, Layman's report, Media work	III/2018	III/2020

Name of Deliverable	Deadline	Status
Laymans' report (in english, as an Annex with the final report)	08/2020	n/a. New planned deadline is 30/11/2020 submitted with the Final Report.
Press release about the UPACMIC project	02/2015	Submitted with the Progress Report 1.
Project brochure in English and in Finnish	12/2013	Brochures as Annex 4.
Intermediate slide presentation	09/2017	As Annex 5.
Project video clip	06/2020	n/a
Annual project newsletters	06/2018	As Annex 6.
Final slide presentation	06/2020	n/a. New planned deadline is 30/11/2020 submitted with the Final Report.

Milestones name	Deadline	Status
Press release 2 sent to media	12/2016	Submitted with the Progress Report 2.
Press release 3 sent to media	01/2018	As Annex 7.
Press release 1 sent to media	12/2013	Submitted with the Inception Report.
Presentation Materials, Laymans reports and video clip created/finished	08/2020	New planned deadline is 30/11/2020 submitted with the Final Report.
Active screening of dissemination opportunities started	08/2013	Started and on-going.
Press release 4 sent to media	11/2019	n/a

Description of work

The objective of action D1 is to produce various types of communication and dissemination materials which are presented in different events, occasions and in the UPACMIC website. The materials comprise of the project presentations, layman's report, brochures, DVD-presentation, newspaper articles and press releases.
Materials produced in this action will contribute to capacity building of the stakeholders involved and targeted and they will also serve the strengthening the LIFE+ programme brand among all the target audiences.

This action needs continuous observance of relevant medias which would be suitable for UPACMIC project. As the time has changed during the project years, and the circulation of newspapers are decreased, it might be more relevant to publish the articles in web-based media rather than only in the newspapers. The suitable medias are checked on a yearly basis. (E.g. media Taloussanomat was written in the proposal but that media does not publish printed material anymore). Short article about UPACMIC objectives was released in Uusiouutiset (Finnish Circular Economy News), number 08/2017 (Annex 8).

We have produced a brochure in English and in Finnish to be delivered with relevant occasions. The brochure can also be disseminated via e-mail. See Annex 4 for English and Finnish brochure.

We have also created a logo for the project (see Figure 9). Logo was created by RAMFI personnel (graphic designer).

Figure 9. UPACMIC logo.

Modification of action compared to project proposal
In the proposal DVD presentation was mentioned but as the media world has changed fast during the project years, DVDs are not anymore suitable deliverable for stakeholders. Instead, project video clip will be made, and it will be published in the project website and for example in Youtube channel.

Problems encountered
No problems encountered other than the general project delay.

Indicators of progress:
- Number of Presentation materials: brochures (1 A4 page) in finnish and english - 5000 pieces (3000 in English, 2000 in Finnish): *English and Finnish brochure printed, both 400 pieces. As it is a trend nowadays, less printing material is produced, and the brochure is also distributed by e-mail*
- Number of Layman´s reports - 3000 (2000 in english and 1000 in finnish): n/a
- Number of project presentations like slide presentations (finnish, english, swedish, different emphasis) – 6: *Current presentations are in Finnish and in English*
- Number of annual newsletters (published yearly, April) – 4: *3 newsletters published, there might be 5 newsletters due to the project time extension*
- Number of DVDs - 1 type (500 copies): *DVD is outdated dissemination material type so this will be replaced by video clip that is loaded in the website and in e.g. in Youtube*
- Number of press releases – 4: *3 press releases done, there might be 5 press releases due to the project time extension*
- Number of newspaper articles - 10 (from which a smaller amount is expected to be published): *currently 4 newspaper articles published*
- Active media work carried out resulting in at least 2 interviews: *1 interview done in accordance with newspaper article*
- Materials kept updated throughout the whole duration of the project: *ongoing work*

5.4.2 D2. Life+ Information Boards

Name of activity	Planned deadline	Actual progress
Life+ Information Boards	II/2014	IV/2019

Name of Deliverable	Deadline	Status
-	-	-

Milestones name	Deadline	Status
LIFE information boards placed near the site	06/2014	Erected for Hitura site (cover structure).

Description of work
The objective of this action is to erect two LIFE+ notice boards but as there will be other piloting sites in addition to Hitura Mine, there might be even three notice boards. One has been erected to Hitura site (see Figure 10).

Figure 10. LIFE+ Information Board in Hitura site.

Modification of action compared to project proposal
There might be need for total 3 separate LIFE notice boards as the piloting structures are probably piloted in different locations instead of one, as written in the proposal.

Problems encountered
No problems encountered other than the general project delay.

Indicators of progress:
- Number of erected Life Notice boards – 2: *1 is already erected but the total number of boards might be 3 finally*

5.4.3 D3. Project Website

Name of activity	Planned deadline	Actual progress
Project website	III/2018	III/2020

Name of Deliverable	Deadline	Status
-	-	-

Milestones name	Deadline	Status
Web page operating	10/2013	Operating and updated on a regular basis

Description of work
The objective of this action is to communicate the project's objectives and results to improve the awareness of a sustainable and eco-efficient mine construction method. The website was launched already in the beginning of the project as described in the proposal and the webpages have been updated at least 1-2 times a year. Figure 11 presents the front

page of the project website. There have been some delays with the updates as the person in charge of the website has been somewhat absence due to various reasons.
At the moment there are no links to other projects in the UPACMIC website, but this will be updated on first quarter of year 2019 as we will go through relevant projects, and also to strengthen our networking at the same time.
The address is: http://projektit.ramboll.fi/life/upacmic/index_eng.htm

Figure 11. Front page of the UPACMIC webpage.

In addition, UPACMIC project has a Twitter account (@UPACMIC) which was not foreseen during writing the proposal. Twitter use needs still some learning and activating from the beneficiaries and we consider some training in social media utilisation, as this will serve also project dissemination after the project has ended.

Modification of action compared to project proposal
As described below the indicators of the progress of this action, the levels of succeeding are set very high and we are not sure if these numbers are relevant nowadays as the use of different medias has changed significantly during the project years. We will consider new indicators for the progress for this action.

Problems encountered
No problems encountered other than the general project delay.

Indicators of progress:
The progress indicator used counts annual hits and downloads made in the website. A certain judgement is given for each count, in the following way:
LEVEL 4: no progress
LEVEL 3: low progress
LEVEL 2: good progress
LEVEL 1: excellent progress

- 40 000 hits at the project website annually (average).
LEVEL 1: 20 000 - 40 000;
LEVEL 2: 10 000 - 20 000;
LEVEL 3: 1 000 - 10 000;
LEVEL 4; 0 – 1000: *currently the level of UPACMIC project website visitors is between 400-500 annually.*

- 20 000 downloads of the project information materials.
LEVEL 1: 10 000 - 20 000;
LEVEL 2: 5 000 - 10 000;
LEVEL 3: 1 000 - 5 000;
LEVEL 4; 0 – 1000: *Currently only few downloads from the websites.*

- 20 000 downloads of the guidelines (after the completion of Action B5).
LEVEL 1: 10 000 - 20 000;
LEVEL 2: 5000 - 10 000;
LEVEL 3: 1 000 - 5 000;
LEVEL 4; 0 - 1000.
Currently no guidelines published yet.

- All project partners use the website effectively, qualitative parameter.

5.4.4 D4. Participation in and Organisation of National and International events, workshops, seminars

Name of activity	Planned deadline	Actual progress
Participation in and Organisation of National and International events, workshops, seminars	III/2018	III/2020

Name of Deliverable	Deadline	Status
International workshop proceedings	03/2018	International workshop arranged during the WASCON2018 conference in Tampere, Helsinki.

Milestones name	Deadline	Status

Organisation of National workshop Nro 1 / latest	12/2017	As WASCON2018 conference was organised in Tampere Finland, the organized workshop also served the needs of national issues. The total participants in WASCON2018 was approximately 200.
Participation in 4/4 conferences done, dissemination work there accomplished	12/2019	n/a
Organisation of National workshop Nro 2 / latest	12/2019	National workshop will be discussed to be organised together with event in Ministry of the Environment or UUMA3 national programme.
Organisation of International workshop in Finland / lates	12/2017	International workshop arranged during the WASCON2018 conference in Tampere, Helsinki (https://www.ril.fi/en/events/wascon-2018/program/workshops/alternative-materials-in-mining-environment.html)
Participation in 2/4 conferences done, dissemination work there accomplished	12/2017	Compeleted: WASCON2015 AshTradeConference 2017 WASCON2018

Description of work

This action contains the participation in and organization of professional events. Participation in the events throughout the project has been very important to deliver the information about the UPACMIC project and methods and to learn related topics especially in the field of water processing issues in the mining areas. Until the reporting period UPACMIC has participated on the following events:

- Participation in WASCON 2015, international conference 10-12 June 2015, Santander, Spain:
    - Article "Adequate educational materials and information dissemination as prerequisites of attitude change required for improved resource efficiency performance", authors: Kreft-Burman, K., Korkiala-Tanttu, L. Forsman, J. Niemelin, T., Ronkainen, M. and Svedberg, B.
    - Presentation "Improved legislation, information dissemination and adequate educational materials as prerequisites of attitude change required for improved resource efficiency performance", presented by Ms Marjo Ronkainen
- Project presentation for LIFE Hungary Capacity Building Project in Espoo, Finland, meeting and presentation by Ms Tarja Niemelin
- Kaivosaltaat seminaari (Mining basins seminar) 15 February 2017 in Helsinki, Finland, Mr Tuomas Suikkanen
- Ash Trade Conference 06 April 2017 in Tallinn, Estonia:
    - Presentation "The use of biomass ashes in different infra construction applications", Mrs Tuomas Suikkanen

- LIFE project experiences, invited by LIFE Hungary Capacity Building Project, 10 May 2017 in Budapest, Hungary:
    - Presentation on LIFE project experiences and UPACMIC project, Ms Tarja Niemelin
- The project and experiences were presented in LIFE info day in Helsinki 22 May 2017, Mr Pentti Lahtinen
- The project topics was discussed and studied in the 13th International Mine Water Association Congress in Lappeenranta, Finland, 25-30 June 2017, Mr Tuomas Suikkanen
- The project topics was discussed and studied in "Kaivannaisjätteiden ekotehokas hallinta - KaiHaMe-projektin työpaja" 28 November 2017 in Kuopio, Finland, Ms Merja Autiola
- The project topics was discussed, presented and networked in "Pidä Lappi siistinä" seminar 01-02 February 2018 in Kittilä, Finland, Mr Harri Jyrävä
- Participation in WASCON2018, international conference 06-08 June 2018, Tampere, Finland:
    - Article "Utilisation of by-products and alternative construction materials in new mine construction", authors: Niemelin, T., Autiola, M., Jyrävä, H., Lindroos, N., Kulmala, A., Österbacka, J. and Helaakoski, M.
    - Poster "Utilisation of by-products and alternative construction materials in new mine construction
    - Workshop "Alternative Materials in Mining Environment", presentation by Ms Tarja Niemelin, workshop proceedings by Mr Pentti Lahtinen

International workshop "Alternative Materials in Mining Environment" was organised during the WASCON2018 conference as the conference took place in Tampere, Finland, we currently see that this served the needs of national workshop, too. In the workshop also Swedish company Ecoloop presented their knowledge on the use of green liquor dreg in mining environment and offered their expertise for the project.

In Annexes 9, 10 and 11 the extended abstract, poster and the workshop presentation in WASCON2018 conference are presented.

Modification of action compared to project proposal

It has been written in the proposal that the workshops would be organised in Hitura and Helsinki but due to the changes in associated beneficiaries (Belvedere bankrupt), the possibilities to organize the 2nd national workshop in accordance with suitable event organised by Ministry of the Environment or national UUMA3 programme is studied. The topics will be related to the goals and objectives of the UPACMIC project, mining sector and alternative construction materials.

In the proposal it was presented that the international conference will take place in Oulu in 2017 but this kind of conference will be mainly the final seminar of the project and its location is not yet decided.

Problems encountered

No problems encountered other than the general project delay.

Indicators of progress:

- Number of National workshops organized – 2: *Currently 1, in accordance with the WASCON2018 conference*

- Number of International workshops/conferences (not an expensive scientific conference) organized in Finland – 1: *1 in accordance with the WASCON2018 conference*
- Number participations in conferences (presenting technical publications or scientific paper about the project) – 4: *currently participation in 3 different conferences*

5.4.5 D5. Guidelines and Technical publications on the project

Name of activity	Planned deadline	Actual progress
Guidelines and Technical publications on the project	III/2018	III/2020

Name of Deliverable	Deadline	Status
Guidelines and Technical Publications (for stakeholders, mining sector etc.) + disseminated through the webpage	12/2019	New planned deadline is 30/11/2020 submitted with the Final Report.

Milestones name	Deadline	Status
Paper submitted to 2 conferences	12/2017	Submitted to WASCON2018 conference.
Paper submitted to 3 conferences	12/2018	New planned deadline 12/2019
Paper submitted to 4 conferences + professional magazine (material-lehti)	12/2019	n/a. Professional magazine might be changed. New planned deadline 06/2020.
Paper submitted to 1 conference	03/2015	Submitted to WASCON2015 conference

Description of work
In this action guidelines and technical publications for project stakeholders are created. As the project has been delayed due to Belvedere bankrupt, there has not been activity in this action yet.

- Number of written technical and practical guidelines in Finnish (will be published on the webpage) – 1: *n/a, later in the project*
- Number of written technical and practical guidelines in English (will be published on the webpage, large target audience) – 1: *n/a, later in the project*
- Number of written and submitted articles to conferences and magazines – 4: *2 submissions, to WASCON2015 and WASCON2018.*

5.5 Evaluation of Project Implementation

In this stage (Mid-Term) of the project the methodology and results cannot yet fully evaluated. The project has phased difficulties for reasons that the project has not have impact, such as partner bankrupt but despite the problems encountered the participants has

been persistent in contact with new possible mining companies and discussed with them on the possibilities of UPACMIC applications.

The delays have also caused the increase in the management activities (action E1) as promoting the project has taken much personnel resources, as also amendment requests. Project extension with two years will also increase the management budget. Delays compared to the original plan is described in the Gantt chart in Table 6. Gantt chart is also presented in Excel format (USB stick).

The overall progress in implementation of the project is described in Table 7.

Table 6. Gantt chart of the UPACMIC project.

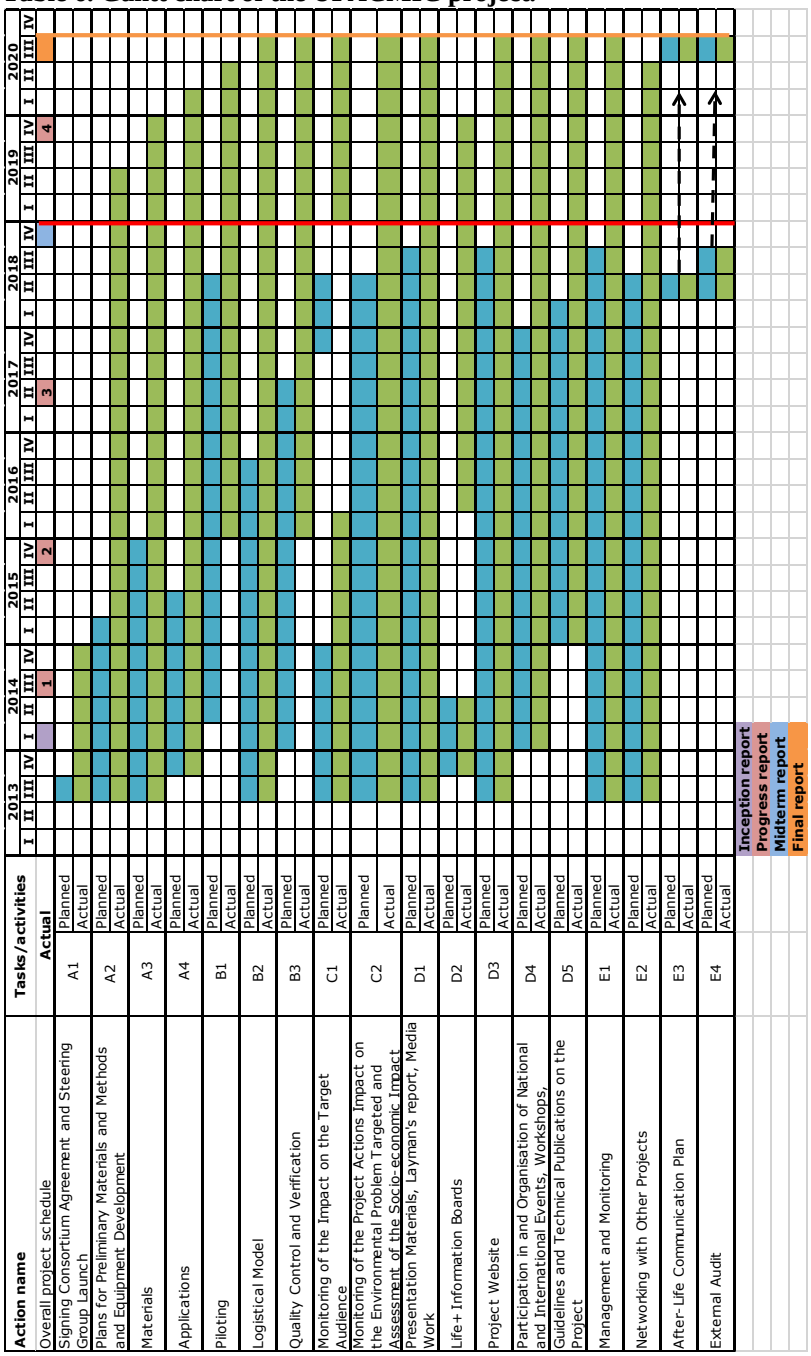

Table 7. Progress of the UPACMIC project.

Action	Objectives and results foreseen in the revised proposal	Achieved	Evaluation
A1	**Expected results:** To form a steering group and practices for co-operation, to sign and deliver the consortium agreement, to interact with the authorities.	Consortium agreement has been signed and delivered to the Commission, the practicalities of the co-operation has been established.	There have not been difficulties implementing action A1, although changes in partners took place immediately when project started and two beneficiaries Lassila-Tikanoja and Hartikainen were changed to Suomen Maastorakentajat and Fortum (previously Ekokem).
A2	**Expected results:** To define the application details and to confirm the material types used in the pilot. Availability of the materials and their locations. Technical, environmental and economical criteria for materials, applications and test procedures set for Actions A3, A4, B1 and B2. Studyplan for the material tests for action A3 finished. Preliminary solution for the equipment innovation development part of the project. Preliminary arrangements on behalf of EKOKEM, to deliver the single-unit/multi-feeder mixing equipment to the Hitura site before piloting starts. More detailed aspects of the auxillary equipment from Suomen Maastorakentajat and Simulation solution form RAMFI.	Application details and the availability of the materials and their locations are mainly mapped and studied and technical, environmental and economical criterias are set (still some work to do with the bottom and reactive dam structures).	Due to the bankrupt of associated beneficiary Belvedere in 12/2015, the project lost the pilot site where the pilot construction was supposed to take place. Equipment development has not progressed due to above mentioned reasons and will not be implemented within the UPACMIC project as described in the proposal. (See action A4 in this table).
A3	**Expected results:** Savings of 500 000 tonnes of virgin materials and about 180 ha of bentonite matt cover. 70 % of the materials used in the pilot structures are waste materials. Minimum three alternative material recipes for each layer of the pilots' structures will be produced. Information and reference data produced for actions A4, B2 and B3. Material matrix that can be replicated in other mining applications will be developed. Sampling, geotechnical and environmental characterisation tests of the potential materials	For the cover structure, at least 80 000 tonnes of natural moraine material are saved. The construction still ongoing. Different material recipes have been developed for different purposes in the laboratory, for the field tests in Pyhäsalmi mine and for the construction of cover structure in Hitura. The amount of recipes is at least 10. Material matrix is yet unfinished as the piloting activities are not completed.	The expected savings of 500 000 tonnes of natural aggregates might not be reached, but it depends totally on the size of bottom and reactive dam structure pilot areas. As the project lost the initial piloting site where all the structures were supposed to be constructed, the structures to be piloted might be smaller than initially thought. This yet does not impact on the proposed solutions and their applicability to replicate the method.

	done.	Extensive material tests completed.	
A4	**Expected results:** 70 % of the materials used during the construction of the 3 pilots' structures are waste materials. Plans for three different pilot applications will ready and allow for the timely start of the piloting action B1. 1) New structure solutions which are applicable to new mine remediation sites. 2) New preliminary ideas will be achieved which relate to challenges and possibilities in structure thickness, structure properties quantification, mixing and feeding of wet/wet; dry/dry and wet/dry materials. 3) The applications innovated, and results achieved will be reported in technical reports as deliverables	New structure solution for cover structure in the mining environment has been planned by using fiber clay to substitute natural aggregates. Preliminary plans for bottom structure and reactive dam are done but not yet implemented.	
B1	**Expected results:** 3 engineering applications determined and planned to be constructed -> savings of 75 % in the use of virgin materials Valuable information gathered to disseminate around the mining industry, contractors, scientific community and legislators. However, the following key results are expected. 1) The superb qualities of intelligent by-product mixtures, and their applicability to mining remediation targets. 2) A direct result of how to use deep mixing technology to insert reactive waste materials to reactive dam structure. 3) A direct result of how to use layer stabilization technology to construct functional sealing layers. 4) Huge masses of materials are transported into mining area. Best practices of handling capacity and open space issues for materials and machines, transportation inside the site and open air handling of materials, are verified. 5) State of the art information of applicability of single-unit/multi-feeder system prototype to	Different by-product mixtures have been tested in the laboratory and in the field tests in Pyhäsalmi Mine. Deep mixing and layer stabilization technics might not be used in the constructions as it was initially estimated. The cover structure by far is constructed using conventional equipment such as excavators and compaction equipment. Material handling and their utilization properties in the field will be reported in the relevant reports. This information is crucial especially for changing weather conditions. Initially four technical reports has been proposed as deliverables, but as mentioned in chapter 5.2.1, we suggest combining these reports to one technical report as all structure development produces information and	The expected savings of 500 000 tonnes of natural aggregates might not be reached, but it depends totally on the size of bottom and reactive dam structure pilot areas. As the project lost the initial piloting site where all the structures were supposed to be constructed, the structures to be piloted might be smaller than initially thought. This yet does not impact on the proposed solutions and their applicability to replicate the method. Even though the intended uses of stabilization techniques might not take place in the project, it does not impact on the replicability or transferability of the project results as the construction can also be done by conventional equipment.

	alternative material blending, and alternative construction material development. Four technical reports will be written about each of the pilots and a summarizing final report of all the experiences of the mine remediation with alternative construction products.	synergy between structures and these issues should be studied together.	
B2	**Expected results:** Regional co-operation network will be created and serve the needs of this project and possibly some similar applications that might follow. Logistical model created and take into consideration the effect of storage to the material and other logistical parameters such as transportation methods, amounts and distances. A feasibility model will be created to analyse the overall cost structure of mine construction (including transportation methods) and to allow succesful and realistic planning of replication operations. Development of technical recommendations document.	Network has been created already in the early stage of the project. Logistical model is under development as the bottom structure and reactive dam structure are not yet piloted. Technical recommendations will be finished after all the piloting is finished.	These results will be achieved as intended, but their finalizing needs also the piloting construction data from the bottom structure and reactive dam structures which are not yet piloted.
B3	**Expected results:** 1) To give an answer if it is possible to create reliable quality control system for industrial by-products 2) A SWOT model (including strengths, weaknesses, objectives and threats) for each of the quality control method/technologies will be compared and the most suitable is evaluated. Due to comparison and demonstration of the most suitable method, best practices for quality control methods can be created. 3) The action will answer the question, was the demonstration site constructed according to rules and quality standards developed for these materials and the overall mine closure environment?	These results are under examination now as the cover structure piloting has started and is yet ongoing. To finalize these, information from bottom structure and reactive dam structure is also needed.	These results will be achieved as intended and there is no reason why reliable quality control system, best practices or quality construction would not be accomplished.
C1	**Expected results:** It is expected that the results of the first KAP questionnaire will provide a good overview of the current awareness and attitude concerning the eco-efficient use of secondary materials and sustainable infrastructure planning and construction. It should also provide	We got a good overview from the first KAP questionnaire and the results has been submitted to EC and also presented in WASCON2015 conference in Spain.	We will conduct the second KAP survey by the end of the UPACMIC project as dissemination of the project results has to be done first.

	the project team with a better and updated understanding of the information needs that will be addressed by the project. The KAP survey will be conducted twice and it will reach 750 recipients every time. It is expected that the project team will receive 550 answers to each KAP questionnaire.		
C2	**Expected results:** - The LCA/LCC studies will be performed and include the data provided by project Implementation Actions. - LCA/LCC studies will provide a proof that the use of the project proposed methods and procedures in the tailings dams closure process results in a more favourable impact on the natural and built environment and human health and wellbeing by a diminished use of use of natural resources, energy and transportation as well as minimizing the waste streams disposed at landfills. - The Preliminary results will be presented at various dissemination events prior to the final report (eg. project seminars, the international conference, networking activities). The expected audience is 500 persons. - The verification results including the statements of the external experts will be published in the form of a report at the end of the project period and placed at the project website at the beginning of 2018. The link to the report will be actively disseminated through the project newsletter to 1500 recipients. - The results of Action C2 will in the long run give background for a legislative change as the authorities have lacked enough sound information and well-documented cases in order to proceed with the decisions.	LCA/LCC studies has started as the construction of cover structure is started. To finalize the studies, also bottom structure and reactive dam structure construction data is needed. Preliminary results are expected to be ready during the 1st quarter of year 2019 and the results will be published in UPACMIC website and delivered to relevant stakeholders.	LCA calculation methods for infra construction and system boundaries for recycled/recovered materials are under discussion at the moment and a lot of new information is available compared to the situation when the proposal was written. We are expecting good results with the verification report, although we are aware that long distances in Finland will create challenges for the transportation point of view. The results will be analysed thoroughly giving important information for the method to be replicated.
D1	**Expected results:** The work done and outputs created in this action are concrete dissemination materials. They are materials that are sent, given and shared with all interested parties related directly or indirectly to the	Even though the project implementation is delayed, a lot of dissemination activities has been done within the project. The project methods, objectives,	The project and its methods has got positive interest from the field. It seems that the difficulties which raised in the mining field/world markets immediately after the project started impact still on the

	project. The produced materials and their sharing will contribute to capacity building of the stakeholders involved and target audiences. In addition the communication and dissemination materials created, will result into effective strengthening of the LIFE+ programme brand among all who receive dissemination materials. After this action, plenty of good quality and multifarious material will be available to support the communication and dissemination actions of the UPACMIC project. The dissemination and sharing of the material produced will be done according the communication plan created in action D1. Accomplished media work, is crucial for achieving enough capacity building to target the development of recycling society. More quantitative information is written on the indicator of progress part of this action.	material possibilities, preliminary results, project phases and difficulties has been disseminated in various occasions. Project brochure (A4) has been distributed whenever possible and relevant and project has also own logo. For the last years of the project and more effective dissemination, we also think some small sustainable marketing product to be purchased, with the project logo. Project has also created a roll-up. Project has a twitter account @UPACMIC.	general progress of the mining industry. As the use of recycled/recovered/alternative materials generally in infra field is getting more and more attention nowadays in Finland, this will also impact positively on the UPACMIC possibilities. National UUMA3 programme is promoting the use of above mentioned materials and through this the knowledge, awareness and possibilities also gradually will reach the mining industry. We will activate on the use of Twitter, and to boost the utilization of social media, we will discuss together on the means and possible training needs within this issue.
D2	**Expected results:** The erection of LIFE Information boards, is a concrete step towards better dissemination and improvement of the LIFE+ brand.	LIFE Information Board is set up at Hitura Mine where the cover structure is constructed.	LIFE Information Boards will be erected to all piloting sites (bottom and reactive dam too).
D3	**Expected results:** This Action will result in a well-designed and user-friendly project website. The stakeholders and the target audience will be informed about the project progress and news with the frequent updates. The page will create a forum for communication for the stakeholders, target audience and other bodies interested in the project. It is expected that the interactive functions of the site will engage the users in discussions and provide comments. The site will also bring improved awareness of similar projects by offering links to them. It is also expected that the project website will improve the general awareness of the LIFE brand.	Website was launched in early stages of the project and the pages are updated at least twice a year to keep the data updated and to be sure the contact information is correct.	We are satisfied with our current webpages, but we will activate the updates now during the last years of the project to keep more updated information and events on the website. Also, the link to KAP questionnaire will be set to the webpage when the project end is getting closer. The link is also actively shared for our network.
D4	**Expected results:** - Two national events organised. The expected number of	At the moment an international workshop was organised during the	National seminar been planned to organise in Hitura Mine, and to have a press

	participants for each national event is 100. - One international conference organised in Finland. The target for the participants is 200. - Effective dissemination of knowledge allowed by participation in the national and international events (3-4). - The awareness of the methods of utilization of alternative construction materials in mine remediation site, positively affected. - The events have served as forums for discussion and exchanges of experience. - The network established by the UPACMIC project strengthened.	WASCON2018 conference in Tampere, Finland. Dissemination has been done in several occasions, to be mentioned WASCON2015 in Santander, Spain, WASCON2018 in Tampere, Finland and Ash Trade Conference in Tallinn, Estonia as for international events. For national event the project topics were discussed and presented in Kaivosaltaat (Mining basis) seminar.	conference at the same event. Final seminar of the project will be organised in 2020 when the project is coming to an end and this event will be international.
D5	**Expected results:** Papers will be sent to conferences. One paper is sent to 4 different conferences and one mining industries professional magazine (materia-lehti) - Vuorimiesyhdistys ry. The active dissemination effect of guidelines and technical publications will be remarkable for the individual legislators. Well prepared guidelines concerning the by-product utilization will give the legislator in depth change to familiarize in the positive effects of UPACMIC project and the technosphere of alternative construction materials. Legislators have a change to absorb information at their own pace from technical reports and guidelines.	This action is not fully active at the moment as the pilot constructions of bottom and reactive dam structures are not yet piloted. The guidelines will be prepared in the final stages of the project when all the relevant data is available. Papers are sent to conferences (already to WASCON2015 and WASCON2018)	This action will start properly later on final stages of the project when there is enough data to create guidelines.
E1	**Expected results:** The project will be carried out with respect to the Grant Agreement between the Commission and RAMFI as the coordinating beneficiary, and with respect to the Common Provisions as annex of the Grant Agreement. The project director (coordinator) and the project manager will work very closely in order to successfully manage the project. They will be in continual touch with all the Action Managers in RAMFI and the partner organisations. The project team meetings will be organised regularly, at the interval of 3 months and this will assure a proper	The coordinator RAMFI has been actively in contact with the beneficiaries by phone, e-mail and meetings that has been organised 1-2 per year. Skype meetings has also been organised when needed, due to long distances between beneficiaries.	Due to the 2 year extension of the project duration, more management activities has been needed and will be needed compared to the initial 5 year project duration. Due to the changes in partnerships and bankrupt of Belvedere, two amendments has been compulsory to make and it seems that one more amendment is needed for budget category changes. Finding pilot sites means also several conversations and meetings to progress the project objectives.

	level of monitoring and cooperation. This will lead to a well-managed project that is able to perform all the project actions according to the timetable. The project management team will be supported by the work of the Steering Group. The regular meetings of steering group (see action A1) will result in a good level of cooperation.		
E2	**Expected results**: It is expected that the UPACMIC project will successfully map the relevant EU projects and localise the contact persons in the early stage of the project duration. The project team will be in touch with other teams and they will establish a working cooperation network. The list of the projects will be updated once a year in order to allow for the inclusion of the new relevant projects. The network members will be invited to participate in Skype conference once a year during the project duration. It is expected that the network might connect about 10 different projects in the years 2013-2018. The results of the UPACMIC project will be made available in an active way to the network members, and others will benefit from the knowledge generated and lessons learned. In the same way it is expected that the UPACMIC will benefit from the knowledge and experience of those projects concerning both the content and successful management tips. Two reports will be created in this action. One at the beginning and one at the end of the project life.	UPACMIC has done networking mainly by contacting project straight by e-mail. LIFE Hungary Capacity Building Project contacted UPACMIC, made a project visit and mutually invited UPACMIC to Hungary to share LIFE project experiences in May 2017.	As the project has suffered from severe delays and there has not been that much to share yet, the networking activities has been more less than initially was thought. As the project final years are now ahead and there are already data and experience on the cover structure piloting, networking shall be activated starting from the beginning of 2019.
E3	**Expected results:** The After-Life Communication plan will be designed in a cooperation of the project partners and stakeholders and it will enable a good level of dissemination of the project results for the period of five years.	n/a	After-Life communication plan has not been prepared yet. The work has to be started in 2019.
E4	**Expected results:** This action evaluates the accounting details of the project, and summarizes the project as accomplished.	Midterm audit was done per 31.12.2016 by PricewaterhouseCoopers Oy. As the audit was midterm audit, no report	

	Audit report will be included in deliverables.	was conducted at this stage.	

5.6 Analysis of long-term benefits

Long-term benefits are still mainly to be studied as only the cover structure has been piloted full-scale and we are searching pilot sites for the bottom structure and reactive dam structure. In next chapters the outcome benefits are discussed shortly reflecting the current situation of the project.

5.6.1 Environmental benefits

At the moment, approximately 80 000 tons of natural moraine has been saved during the cover structure construction in Hitura mine. Moraine is coarse soil type through which the rainwater and melt water filtrates, generating ground water (see Figure 12). The cover structure piloting was part of a bigger construction work in order to have comparative information on the work methods and structures. In addition, above the cover structure in the soil layer, industrial secondary materials such as branch waste and decomposition are used, and this also has saved natural soil materials ~5000 m^3

Fiber clay structure is technically better structure than moraine structure, as fiber clay has better water permeability which is important for this kind of structure. If fiber clay would not be used for construction purposes, the material would be combusted as it is expensive to storage large amounts of material. Fiber clay though does not have actual proper heat value due to high water content, so the utilization is important from the resource efficiency point of view.

Expected results of the UPACMIC project is to save in CO2 emissions, but at this stage of the project the savings are not calculated yet. We will produce this information later in the Verification stage when the streamlined LCA/LCC calculations are done.

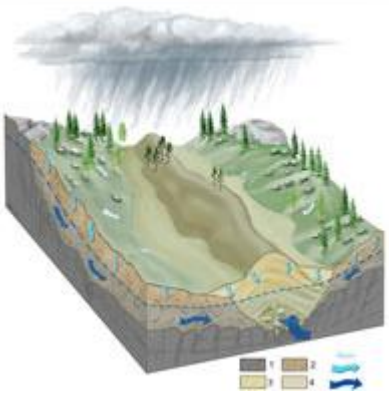

Figure 12. Groundwater formation 1) solid rock, 2) moraine, 3) esker formation, 4) sediments of fine sand and silt. (Reference: Geological Survey of Finland).

These natural esker formations are important ground water formation areas and if the aggregate material from the eskers are utilized, nothing can bring back these formations. This kind of use of alternative use materials is very important especially in Finland, as we use approximately 15,5 tons aggregates per capita according to the Finnish Environmental

Institute. This rate is one of the highest in Europe due to abundant reserves of aggregate materials in Finland. We find this one of the key aspects and of the UPACMIC project objectives.
The use of recovered/recycled/alternative materials is 'reuse' according to the Waste Framework waste hierarchy (Directive 2008/98/EC). In case fibre clay would not be used in this kind of application, the material would be utilised in landfill structures but as the number of landfills is to be decreased, old ones are shut down and no more new landfills are based, new innovations for the material is needed.
Utilisation of alternative materials will also bring positive impact for the mining industry which has been many times on a negative spotlight because of various environmental related problems. For the European competitiveness it is important that mines have environmentally and economically safe surroundings to operate.
UPACMIC project brings together different industries, such as paper and forest industry with mining and construction industries. Co-operation is essential to create solutions together and to efficiently as possible take steps towards resource efficiency.
New Government Decree (843/2017) on the recovery of certain waste in earth construction has come to effect in Finland starting from 1st January 2018 and the results of the UPACMIC project will also improve know-how and awareness of the alternative material (waste) utilisation in earth construction applications.

5.6.2 Long-term benefits and sustainability

Cover structure has been constructed by utilising partly dried fiber clay (fiber suspension), which is a paper industry by-product. Fiber clay has been used in landfill sealing layers for a long-time, but now it has been used for the first time in the mining environment.
Fiber clay is easily workable and light material and has a good resistance against deformations. The material does not crack when drying, as does some natural soils. This will help fiber clay to maintain the low water permeability, which is essential to keep the structure functional. The material can be transported and stored to the construction site already in the winter time, so the material ready for construction purposes as soon as the soil frost has melted in spring[1].

In Hitura Mine, three different fibre clays (from different plants) has been used. The use of fibre clay has brought financial savings, but the final number is yet to be calculated. The UPACMIC method has brought good reputation for the Hitura Mine. In the surroundings of Nivala, where Hitura mine locates, many people lost their jobs when the mining company went to bankrupt. Now the construction activities to shut down the mine has brought vitality to the area as the construction workers have work and the local hotel & restaurant has customers on a daily basis.
Experiences from the cover structure piloting has brought especially for Fortum new know-how and the company can refer to the project when negotiating with new opportunities.

Long-term benefits and sustainability will be complemented as the project progresses with the bottom and reactive dam structures.

5.6.3 Replicability, demonstration, transferability, cooperation

The construction method of the cover structure has been conventional construction method where excavators has been used. Compacting of the layers has been done by driving on top of the layer exact amount as has been written in the working methods. This kind of construction does not require special equipment, but attention must be paid to the handling of materials (fiber clay).
Fiber clay can be processed to the desired form for example with crawler based working machines. When spreading the material, also wheel loader can be used. Fiber clay is usually compacted in the structure with two layers but the final compaction work amount is determined based on available machinery and test structure[1].

The construction does not require special equipment, but few new methods for shaping and working has been implemented and the use of fibre clay in the mining environment is easily replicated and know-how transferred. The method will create new business opportunities e.g. with material processing, storage and other material related issues. Resource efficiency is important as the whole society needs to take actions towards circular economy practices.

5.6.4 Best practice lessons

It has been found a challenge due to long distances in Finland to make the pilot construction structures cost-effective as the transportation costs can rise too high. This might be a problem in sparsely-populated Scandinavia but in elsewhere in Europe the transportation cost or distances are not that high.

This is also related to the storage of the materials, so that there is enough material available for the needed structures. This issue will be also studied in action B2 Logistical Model.

Based on the experiences in cover structure piloting, following issues has been found in order to make the use of alternative materials possible:

- Project group/constructor has to have a genuine desire to use alternative materials and to save natural resources
- Quick decision-making processes are needed for material choices
- The designer has to have know-how, understanding and experience on different possible material choices
- The constructor has to have sufficient experience and skills to construct with different materials in variable circumstances and different type of sites
- Preliminary tests and test structures are needed to guarantee quality construct

5.6.5 Innovation and demonstration value

Technical Readiness Level TRL of UPACMIC methods for the cover structure is approximately at level 7: Operating in operational environment at pre-commercial scale. The bottom structure and reactive dam structure are not yet defined but they will be on a scale 5-7 depending on how demanding the initial situation in the coming piloting sites is.

We think that the demonstration value of the UPACMIC project by EU funding is extremely crucial, as without EU funding this kind of applications would not have been able to test and construct. This demonstration is important in Finland where the use of natural aggregates is highest in Europe (15,5 tonnes per capita) and the protection of ground water formations are important to secure the clean drinking water supplies.

5.6.6 Long term indicators of the project success

Future indicators for the project success are:

- number of applications in the mining environment where alternative materials are used (first in Finland, then in Scandinavia and gradually in Europe)
- number of conference writings
- citations on the project deliverables and conference writings
- requests to share experiences on the method and the project
- visits at the website
- number of viewings of the project video (finalized in the end)
- how well the structures function during the follow-up period
- how many new design sites are interested in the UPACMIC methods

References:

1) https://www.metsatissue.com/en/AboutUs/Operations-in-Finland/Suomi/tuotannon-sivutuotteet/Pages/default.aspx