

# DELIVERABLE D.T4.2.1

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Evaluation report for pilot action monitoring  
and assessment of preparation strategies.

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## I. DESCRIPTION ASSUMPTION EXECUTED IN D.T4.1

### I. 1. Description assumptions within the project ProteCHt2save performed in T4.1

Various crisis situations, disasters and cataclysms pose potential threats to existing cultural heritage resources, causing irreparable material losses but also social and cultural ones. That is why it is so important to support and develop practical tools for identifying the risk of cultural heritage threat posed by climate change and sudden weather phenomena.

One of the more important goals of the ProteCHt2save project is to support the creation and development of preparation strategies and emergency plans for protection of cultural heritage in emergency conditions; to this end WPT3 and WPT4 especially work hand in hand with their developments, testing phases and adjustments. The main development of the presented strategies and plans is based on the adaptation of good practices in Central European countries, as collected, analyzed and prepared for adaptation by the individual pilot sites in WPT3, and the analysis and conclusions drawn from pilot actions carried out in 7 member countries. Thanks to the development of the best preparation strategies and plans with procedures for dealing with various crisis situations, the protection of historic cultural heritage against catastrophic atmospheric phenomena will significantly improve.

WPT3 and WPT4 go hand in hand as the individual pilot actions test the strategies for the single pilot sites developed in WPT3, analyze and adjust them according to the findings of the analysis of a) the individual pilot actions and b) the transnational strategy as a whole. The individual pilot site strategies were developed in D.T3.1.2, following a transnational strategy outline. This transnational strategy outline itself is firmly based on a SWOT analysis of the existing plans on managing cultural heritage in emergencies (D.T3.1.1), which also highlights best practice examples. Thus the individual strategies tested in WPT4 follow the disaster management cycle, which clearly states that preparedness is of key importance and that the cycle never ends, meaning that there will always be lessons to be identified and learned from each occurring event. The first step for preparing the individual strategies was a risk assessment, followed by the definition of internal responsibilities and the creation of the emergency plan, which was put to a test in the seven pilot testing's of WPT4.



In carrying out the tasks of the project under WP T4.1, it was necessary to organize and conduct 7 practical exercises at the pilot sites in the members' countries. Pilot actions have been divided into two groups:

1. Practical exercises to check the use of preparation strategies in cultural heritage areas in the event of flood, fire due to drought and heavy rain.

Within this group, the following activities were carried out:

- T4.1.1 Pilot action 1 - preparation strategies for the historic center in Czech Republic - pilot action concerned testing of strategies in the event of a flood.
- T4.1.2 Pilot action 2 - preparation strategies for the historic center in Austria - the strategy was tested for two threats: flood and fire due to drought.
- T4.1.3 Pilot action 3 - preparation strategies for the historic center in Italy - the strategy has been checked for the threat of a heavy rain precipitation.

2. Practical exercises to test evacuation plans in emergency phase in cultural heritage areas in the event of flood, fire due to drought and heavy rain.

Within this group the following activities were carried out:

- T4.1.4 Pilot action 4 - Emergency plans for heritage sites involved in Slovenia - the plan was tested in the event of a heavy rain threat.
- T4.1.5 Pilot action 5 - Emergency plans for heritage sites involved in Croatia - the plan was checked taking into account two threats: heavy rain and fire due to drought.
- T4.1.6 Pilot action 6 - Emergency plans for heritage sites involved in Hungary - the pilot action concerned the flood hazard.
- T4.1.7 Pilot action 7 - Emergency plans for heritage sites involved in Poland - exercises were organized in terms of the threat of a heavy rain.

Lessons learned, assessment and comments regarding the differences between the planned activities and the work actually understood by rescuers and others involved at the site will contribute to the development and improvement of the security of cultural heritage. This is a core part of ProteCHt2save, since the strategies developed in WPT3 need testing, evaluation, analyses and adaptation in order to reach the goal of the project itself, the best possible preparation of cultural heritage for emergency situations due to climate change.

## II. PILOT ACTIONS

### II. 1 T4.1.1 Pilot action 1 - preparation strategies for the historic centre in Czech Republic

The Czech partner of the project conducted a pilot action at the Trojan Horse Gallery in Prague Troja on December 16, 2019. The gallery building has one elevated storey without underground space. The property is about 0.01 km from the Vltava River. The biggest threat to the Troja district and its cultural heritage are floods due to



which the level of the Vltava River rises. Flood protection was built at the river. Unfortunately, it is too low, so only part of the district is protected.

The main topic of the exercise was testing and evaluation of the preparedness strategy for Troja Municipality, prepared in WPT3 following the ProteCHt2save Transnational Strategies for Cultural Heritage Protection in Emergency Situation in Climate Change. In particular briefing and evacuation plan for Trojan Horse Gallery and flood protection measures for immovable artwork. The specific objectives of pilot action were:

- Individuate responsibilities for decision making according to the relevant skills of the stakeholders;
- testing the use of the *CULTURAL HERITAGE RESILIENCE - Manual for owners*;
- set priorities and adequate response actions;
- exercise the evacuation of movable heritage and the implementation of preventive protection measures against flooding for large artifacts.

Testing preparation strategy consists of two main parts. The first concerns the design of the evacuation plan. It contains information on strategies and methods and their dissemination among interested parties to build greater resilience of cultural heritage. In addition, we will find in it a division of responsibilities, methods of communication and transfer of responsibility from warning to the occurrence of a crisis





event. In addition, it defines responsibilities, roles as well as operating and response procedures divided into various flood scenarios. The second part of the strategy provides information on the implementation of the evacuation plan, including rescue and prevention measures against floods. Refers to the cooperation of emergency services, among rescuers, owners and local authorities: Municipality of Praha-Troja, National Heritage Institute, NGOs. It covers all aspects of risk management from early warning to damage control and evacuation as well as adequate shelter for people and cultural assets in the crisis phase.



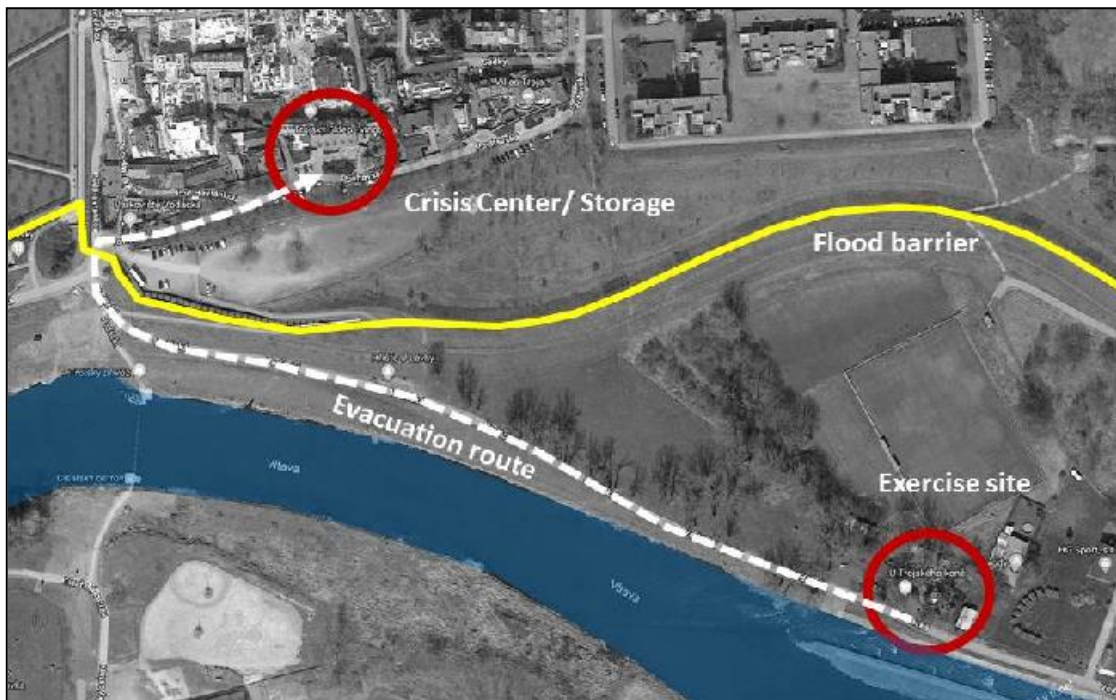
The exercise scenario was prepared following the example of real events in 2002. The plan assumed the occurrence of heavy rainfall (almost 320 mm) for three days, as a result of which a significant increase in water level was observed in the Vltava River. On the second day of rainfall, an alert status was announced along with the erection of temporary barriers in the center of Prague. Due to persistent rainfall in the following days, there is a very high water level in the reservoir above the Vltava river,



as well as record levels in its tributaries. On December 16, a decision was made to evacuate the part of the city where the Trojan Horse Gallery is located. Information to people residing in this area is sent via SMS. A Committee-Rescue Team meeting took place, in which multiple responsibilities were assigned. Immediately after the arrival

of the fire brigade, evacuation of artworks from the pilot site began. The head of the rescue operation issued recommendations on how to evacuate and secure evacuated property. Exhibits are transported to a safe place. In addition, preventive measures have been implemented at the incident site for heavy historic objects that cannot be easily removed from the endangered site.

Prior to the main exercise, the Municipality of Praha-Troja organized an information meeting, setting out specific responsibilities and roles for all participants in the exercise. 74 people, representatives of the following organizations participated in the pilot action: Municipal District professionals, Sokol Troja, Flood Committee, Crisis Unit Prague 7, police, fire brigade and the gallery owner. Three specialized vehicles were used, along with a truck that delivered statue wrap equipment and suitable personal equipment to protect historic items.



Sketch 1. Situational area of the exercises in Czech Republic - flood.

With the exercises carried out, we have learnt the following conclusions:

1. Developed "The manual for owners", which proved to be a very effective tool for knowledge transfer as well as for the training of rescue teams in order to implement preventive measures on site.
2. A Crisis Team, established by the municipality of Troy, which is closely monitoring the development of the crisis and coordinates evacuation and rescue operations has proven to be very useful unit.
3. The development and implementation of an advanced emergency preparedness plan which will further enhance the gallery's preparation for a natural disaster.
4. The tested plan on individuation of responsibilities for decision making according to the relevant skills of the stakeholders should be updated as well as the setting of priorities and adequate response actions.



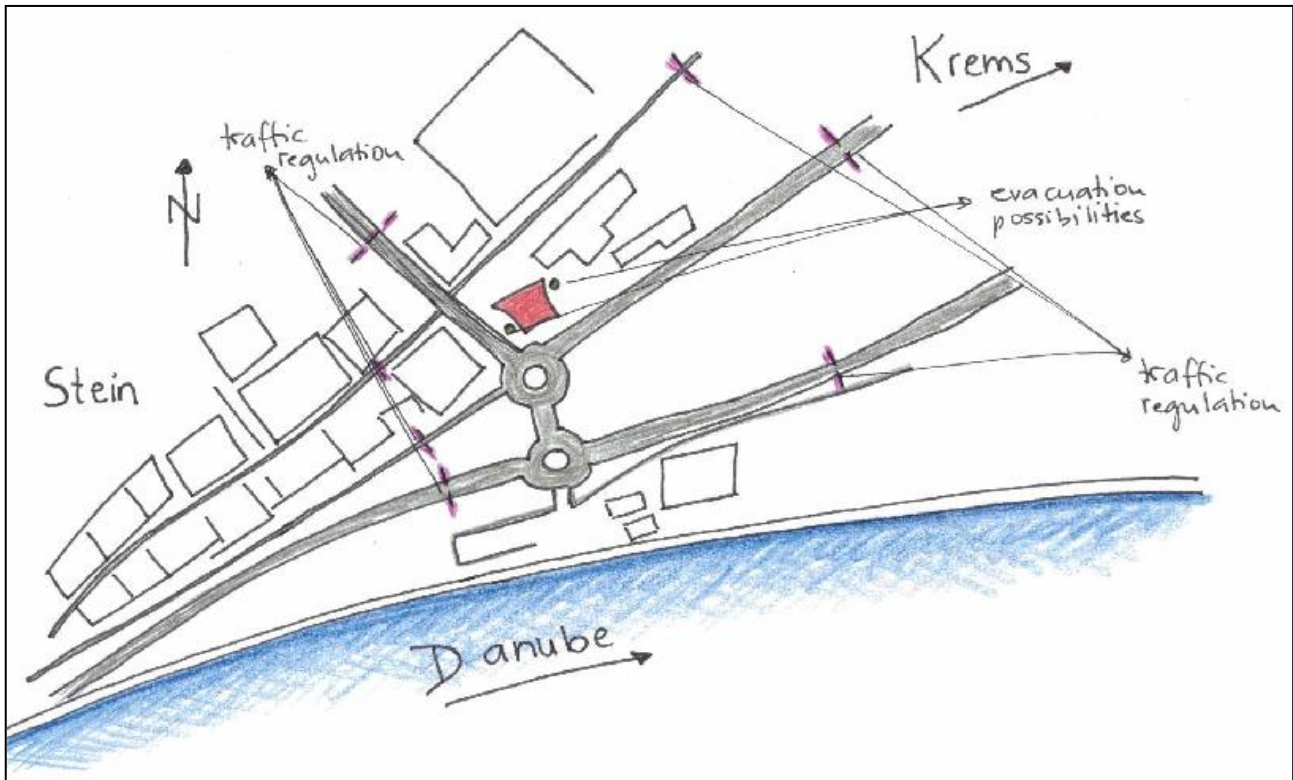
5. In conducted evacuation activities, the number of participants should be reduced to two groups of 8 people and the technical and transport support should be optimized to 2 trucks. A larger number of people and vehicles introduce unnecessary confusion and lack of organization.
6. Training and exercises in the field of evacuation of cultural heritage should be systematically organized for both rescue services and museum staff as well as for society. These classes will have a goal to increase the awareness and knowledge on the sustainable and cost-effective preparedness measures among wider audience.

## II. 2 T4.1.2 Pilot action 2 - preparation strategies for the historic centre in Austria

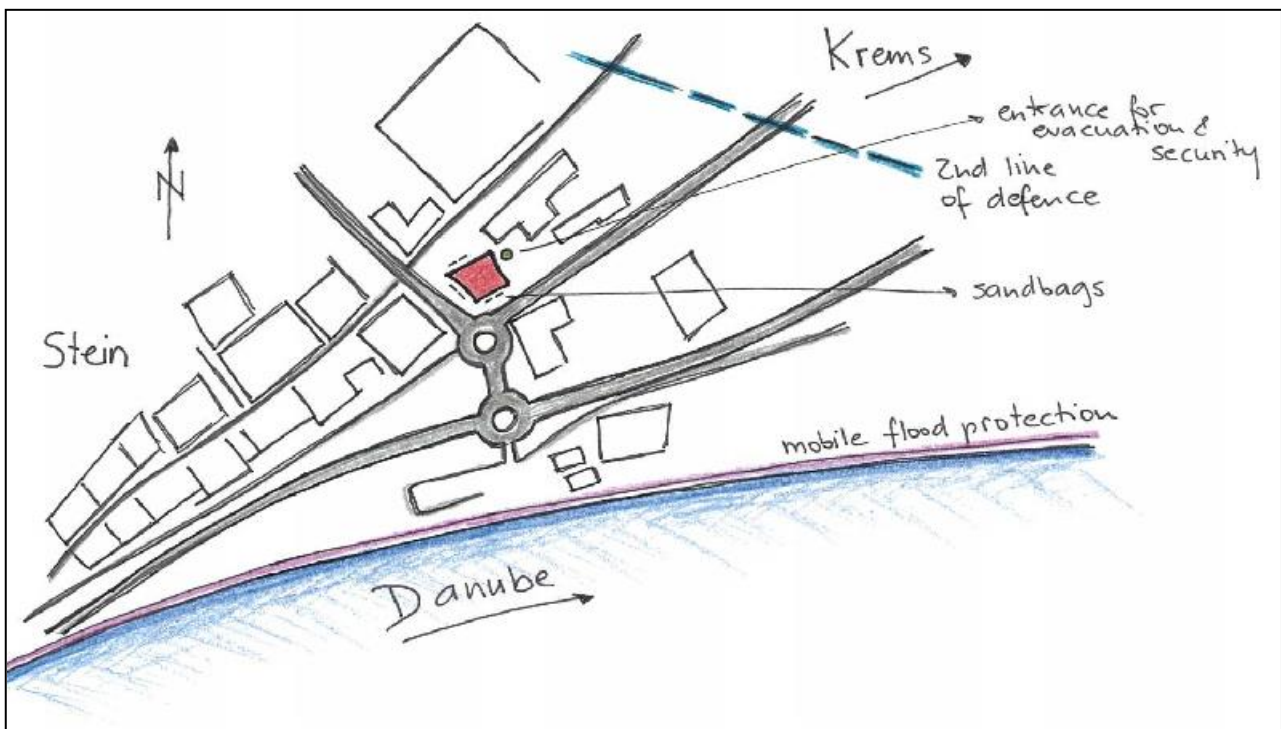
The Austrian partner organized the pilot action in the medieval city of Krems - Stein at the State Gallery Lower Austria. The building is composed of four floors including one underground. It is approx. 0,4 km away from the Danube River. The gallery houses some 100,000 objects, from most important pieces of art from Schiele and Kokoschka to modern artists from Lower Austria. It is an object of great cultural importance in the Stein region. The medieval city Stein, which today is part of the Krems commune, is mainly threatened by the possibility of floods from the Danube River. Stein is a medieval town which lies at the beginning of the UNESCO World Heritage region Wachau. The medieval town is mostly still intact, the Eastern part of Stein, in the direction towards the medieval town on Krems, is home to a number of high quality museums, including the newly erected State Gallery of Lower Austria.

The main purpose of the pilot action was to test the effectiveness of the preparation strategy for the pilot site in Krems - Stein due to flood and fire caused by drought developed in WPT3. The preparation strategy involves erecting the mobile flood barrier by the fire department when the need arises. The barrier is located along the flowing Danube River from the endangered city. In crisis situations that have occurred so far in the threatened area, the barrier worked very well. In case that the barrier should break or not be high enough, the water threatens the whole area of the medieval city of Stein as well as the chosen site of the State Gallery which might also suffer from a raised ground water level. The second line of defense against the Danube flood does not protect the Gallery, because it is erected behind it if the need arises.





Sketch 2. Situational area of the exercises in Austria - flood.



Sketch 3. Situational area of the exercises in Austria - fire due to drought.

Due to the limited exhibition space and a large number of exhibits, very valuable paintings are stored in the basement of the gallery. A seemingly ideal preventive measure seems to be moving paintings to the upper floors when there is a likelihood



of flood. However, this is a huge threat to exhibits in the event of a fire. Fire due to drought is the second biggest threat that has been identified in Krems - Stein. The developed strategy against water for the State Gallery Lower Austria is also valid for a crash evacuation of the most important objects due to fire. The strategy includes route maps for firefighters or other emergency responders to recover artifacts. The maps display the shortest route to the individual the exhibits. The strategy contains information about the forces and services involved, which depends on the availability and general situation in the area, which may be: fire brigade, army, museum staff and trained volunteers.

Specific objectives for the organize exercise were:

- Checking the emergency system developed for the State Gallery Lower Austria
- Checking the cooperation of firefighters and museum staff
- Improving the awareness of firefighters / first responders for cultural heritage protection



The pilot action took place on July 12, 2019 and included two assumptions: flood risk and fire. According to the exercise scenario, heavy rainfall in Germany and Austria led to immense flooding of the Danube. As a result of constant rainfall, there was a risk of the Danube reaching a higher level than the erected mobile flood barrier.

Unexpectedly, a big tree that flows down the Danube River crashes into the mobile part of the flood barrier and damages it. The water starts to flood out of the river basin immediately pouring into the medieval city of Stein and threatening the State Gallery. Commanded forces of fire brigades and police begin the evacuation of directly threatened parts of Stein. After receiving information about the damaged flood barrier, the museum employees begin the procedure of emergency evacuation of paintings from the basement. At the same time, they request the fire brigade for help. After the arrival of the firefighters, the evacuation operation begins. Firefighters entrusted with the evacuation of works of art receive the route cards prepared for just such an event,

and museum security staff makes sure that firefighters and museum staff can work unhindered in the evacuation itself. The paintings are moved to the upper floors of the museum to protect them from water and prepared for evacuation from Krems-Stein, if necessary.

The second episode involved conducting rescue operations during a fire at the State Gallery. The scenario assumed a fire on the gallery floor. Employees who have noticed a fire notify specialist firefighting services. After arriving at the scene, the fire brigade and the police begin their action. The police is responsible for securing the place and directing



traffic. During the ongoing firefighting action, the Rescue Operation Manager decided to start evacuating the exhibits from the basement. For this the firefighters tasked with evacuation of the paintings use the prepared route cards, giving them information on the high-priority objects and the fastest access route. The evacuation was carried out considering the priorities of the endangered exhibits. The head of the rescue operation has designated a safe place in the neighboring building for storing evacuated paintings.

In addition, the police secured evacuated art works. 4 museum employees and 16 firefighters took part in the rescue operations undertaken. In the event of a real threat, more people from the entities involved, Austrian Armed Forces, Police and trained volunteers would participate.

After analyzing the exercises, it has been learnt that:

1. It is not possible to organize exercises in truly real conditions. The museum exhibits paintings and sculptures of great importance and value, therefore in the exercises (for example), the use of smoke would be out of question. In the conducted exercises, firefighters were encouraged to simulate rescue action in the condition of “heavy smoke” and carrying heavy objects for evacuation, but it was a partial success. The time needed to evacuate a single painting is therefore not reliable. During the exercise, the weather was nice and without rain precipitation, which also means that the result of the exercise is not as reliable as during bad and rainy weather.





2. It is necessary to systematically organize exercises in the field of evacuation of cultural goods to improve the work of rescuers. Further exercises together with firefighters and possibly volunteers would also increase readiness. In addition, additional training on, e.g. material handling, should be offered.
3. The establishment of an internal alarm chain and emergency plan needs to be improved.
4. The nomination of an emergency coordinator seems necessary.
5. Designate places where objects can be evacuated if needed. Places should be different - depending on the type and scale of the emergency.
6. Establishment of an exhaustive priority lists and route cards for the most important objects.
7. It is necessary to prepare material for packing the most important goods. The material exists, but is currently located in the basement, which would mean that in the case of threat by water the packing material itself would have to be evacuated to another floor as well.
8. The development and implementation of an advanced emergency preparedness plan would further enhance the gallery's preparation for a natural disaster.
9. Involvement in main exercises and training the key stakeholders and society would spread awareness and knowledge on the sustainable and cost-effective preparedness measures developed in ProteCHt2save.

### II. 3 T4.1.3 Pilot action 3 - preparation strategies for the historic centre in Italy

On December 10, 2019, the Italian partner conducted pilot exercises in the city's central square: Piazza Della Cattedrale in the city of Ferrara. The main goal of the exercise was to check the suitability



and effectiveness a preparation strategy - The Hydraulic Risk Management Plan for heavy rainfall. The perimeter of the pilot site includes open spaces, squares, where





of Civil Protection Terre Estensi, which takes actions based on a developed risk management plan. This plan identifies the risks, areas and actions that need to be taken to prevent risks and solve problems. The plan includes three phases of activities marked in colors:

- yellow - warning phase,
- orange - pre-alarm phase,
- red - alarm phase

In the event of heavy rainfall, the civil protection procedure provides that the Agency for Territorial Security and Civil Protection provides a hydrogeological warning of adverse weather to all municipalities and designates emergency service officers. Designated duty personnel inform the at-risk residents and companies responsible for maintaining and control the maintenance of security installations. Depending on the situation, all services and institutions concerned take actions provided for, in the plan.

According to the assumptions of the pilot action a thunderstorm hits the city of Ferrara. The rain gauges record the fall of 36 mm of rain in 20 minutes that causes the flooding of several areas of the city center including the



Cathedral Square, the basin and the entrance hall of the Duomo. All open spaces are fully paved and waterproof, the rainwater runoff occurs only through the mixed sewerage network, which are undersized for this kind of events, so the pilot area is flooded. The local Police Headquarters receives, among others, a flood warning of the Cathedral Square. The emergency procedure starts. The first to arrive is the fire brigade which in agreement with the local police, proceeds to close the flooded area, the access roads and the area used for the disposal of emergency vehicles. The Head of Civil Protection informs the Mayor who decides to convene the Municipal Operations Center. The second fire brigade team arrives on site with a motorized fire truck. The Technical Officer of the Fire Brigade assumes the role of Technical Rescue Director. The fire

brigade staff starts supervising the site and collecting data on the current event via electronic device (area size, amount of rain, damage, etc.). The data is sent to the operations center and uploaded to a WebGIS platform. The staff of the Civil Protection Office arrives. The Technical Director of Rescue with the Head of the Civil Protection Office carry out the reconnaissance of the flooded areas, the sewer pipes are still active. The rescue teams are given details on sensitive elements, establishing an order of priority of intervention. It is decided to activate at least two teams of civil protection volunteers, equipped with proper equipment (motor pumps and electric pumps) for the drainage of the water basin and the flooded entrance hall. The Technical Director of Rescue orders the fire brigade teams to set up the motor-pumps in order to pump water into the sewerage system identified by the municipal technical services. The Head of the



Civil Protection Office is requested to set up a light-tower on site which is brought by volunteers. The intervention continues until the remaining water is completely pumped out. Fire Brigade and the Civil Protection Department is requested to the site for damages.

Altogether, 29 people took part in the exercise. They were the police officers, firefighters, security volunteers, city technicians and members of various associations.

Comments and conclusions that were found during the pilot action:

1. The pilot actions confirmed good knowledge of emergency procedures by the involved intervening entities, i.e. police, guards, civil protection, volunteers and local authorities. Rescue groups operated synergistically and expeditiously without hindering one another.
2. Access to the pilot facility is convenient for all emergency services. Rescuers reach a large urban alley with limited traffic, with no cars parked. The main limitation in rescue operations can be scaffoldings, technical working devices.
3. Electronic devices that allow the detection of endangerment and send to the command center all the information necessary to build a detailed knowledge framework on the type and effects of the event is a tool that significantly allows lowering the risk levels of the area.

4. If the quantity of water to be disposed of is very large, a second alternative hypothesis could be to lay out pipes and pumps until reaching the moat of the Estense Castle. In this way the water can be conveyed directly into the moat of the Estense Castle thus discharging into a large collection tank with access to the Po di Volano river.

## II. 4 T4.1.4 Pilot action 4 - Emergency plans for heritage sites involved in Slovenia

The Slovenian partner conducted a pilot action which the main goal was to **check the suitability and effectiveness of evacuation plans in emergency phase - "Fire order" of the Regional museum of Kočevje**. This is a general document that the Regional museum of Kočevje has on this matter. It primarily covers fire, that at present is the biggest threat to the museum. The fire protocol describes in detail the preventive and protective measures that are taken in the building in an emergency. In addition, the document contains an evacuation plan for each floor, which focuses on the evacuation of people - employees and guests, as well as on the evacuation measures of artifacts. The document has information about installations and systems in the building, methods of detecting threats, and types and methods of training personnel in crisis situations. The plan obliges employees to immediately contact a security company in an emergency. The security company will then come to the building as soon as possible having all necessary keys to the doors. In the event of a fire, they will try to extinguish it themselves. If they fail or learn that they need help, they call firefighters and wait for them at the entrance, explain the situation and open the necessary door. The security company responds to all alarms triggered by smoke detectors in the rooms of the building, in most cases they are false alarms. Firefighters don't have to wait for a security company to call them, but they can act in the event of a private individual report a fire.

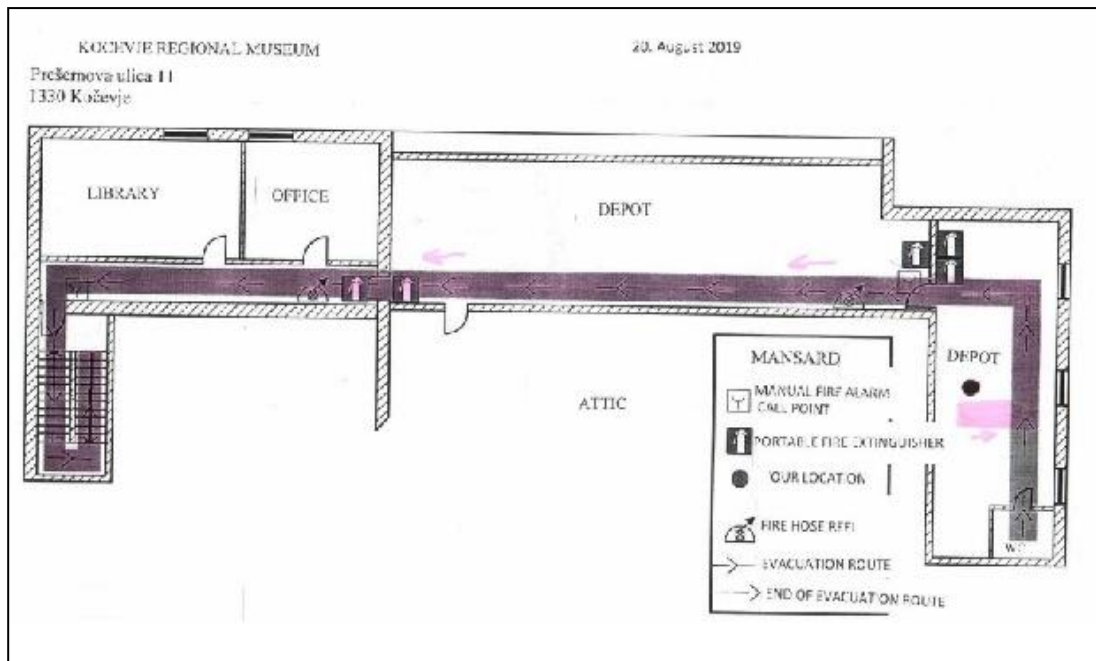


Specific objectives of the organized exercises were:

- checking the cooperation of different departments,
- checking the knowledge of procedures of the persons in charge,
- checking if there is enough light for evacuation activities without electricity,

- checking the usefulness of a single emergency exit in the attic.

The pilot action was carried out on August 20 at the Regional Museum of Kocevje. The museum building has three floors. A large warehouse for exhibits is located in the attic of the building. The attic is very sensitive to moisture and has only one exit. The museum has a plan to install a lift to the attic but has not raised the needed funds yet.



*Sketch 5. Situational area of the exercises in Slovenia - heavy rain.*

According to the exercise scenario, there was a heavy rainfall and strong wind around the pilot site, as a result of which the roof of the building was damaged. Water enters the building through damaged parts of the roof and threatens the historic artifacts stored in the attic. After the threat is observed by the museum staff, the Museum Director and fire brigade are notified. The first at the site is the fire brigade which builds a temporary drainage system to carry out water from the leaking ceiling in the attic. Due to further rainfall, the Heads of Rescue Activities together with the Museum Director decided to evacuate movable cultural heritage, which is located in a storage located in the attic. The Museum Director notifies employees of the situation and mobilizes them to act. A brief meeting with the employees is organized as they are given detailed instructions on how to transfer cultural heritage objects from the attic to a special container located outside the museum. After the brief meeting, the first evacuation phase begins, in which only objects that are most vulnerable will be





removed from the storage in the attic such as: Objects made of paper, wood, textile or similar vulnerable material. In the second phase, the rest of cultural heritage objects are removed (mostly made of metal, stone, glass and other materials) from the attic so a quick reparation of the roof, walls and other parts of the building can start. All the cultural heritage objects will be placed in the container that is situated just outside the emergency exit on the ground floor.



During the exercises, about 150 objects made of fabric, 1000 objects made of wood, 50 running meters of archival material, 500 objects made of glass, stone and metal, and 300 boxes archaeological were removed. Six firefighters from the local fire brigade and seven museum employees took part in the pilot action.

The following conclusions were drawn from the pilot action:

1. The cooperation of departments run smoothly. This turned out to be very true and no problems were detected here since everything was prepared well. The knowledge of procedures of the persons in charge was also checked. The exercise revealed there are no problems here.
2. The museum decided that they need to add new chapters to the existing document "Fire order" or a separate document since important new knowledge regarding evacuation plans in crisis situations is not covered in the existing regulations. The new chapters / document should cover risk assessment and action plan for covering Cultural Heritage protection in the museum for different natural disasters that are most probable (besides fire also heavy rain and wind). Evacuation activities will take more time than initially anticipated.
3. During the exercise, they wanted to check if the rescuers could cope with no power (electricity), only with their own lighting systems. The evacuation team wore head-lights, which worked well during the pilot operation. Exercises were carried out during the day, so it could not be an adequate test.
4. The museum must take better care of the evacuation routes - they must be clear at all times.
5. The only emergency exit from the attic is a partly wooden staircase. In order to secure the emergency-exit from the attic in case of fire, the museum





management plans to install an elevator. Unfortunately, at the moment the museum has not provided the necessary funds for this purpose.

6. The width of the staircase leading to the attic is sufficient for safe evacuation of historic artifacts. Rescuers can safely pass each other on the stairs.
7. Regular evacuation exercises and trainings should be prepared for first responders and the knowledge on the specific of handling the cultural heritage objects and buildings should also be exercised, following for example ProteCHt2save's Recommendations for Rescuers in Emergency Phase for Cultural Heritage Safeguard. It would be useful to expand legal regulations that would impose the obligation to execute emergency evacuation exercises also on cultural heritage. Firefighters and other first responders would benefit and welcome such exercises. For now, the only emergency evacuation exercises in case of fire that are obligatory by law, is the evacuation of people.
8. A legal obligation should be imposed to have adequate rescue equipment and protective tools on rescue units closest to historic buildings for their effective and efficient rescue. Firefighters participated in the exercise unfortunately, don't have specific tools that would be needed in such emergency events:
  - If they had an adequate tilt, they could cover the whole or the vital part of the building in order to stop the water coming into the attic - if the roof was damaged.
  - Using a pump for removing the water from the floor of the attic could prevent further damage to the floor and the objects placed on the floor.
9. To exchange good and bad practices, the museum management decided to organize regular events on the topic of protection of CH against natural disasters with the Community of Museums in Slovenia.
10. To improve the security, the museum management decided to organize for all the local firefighters a guided tour in the museum, so they can get to know better the building and its content. After these guided tours, they will organize a meeting with a smaller group of firefighters that will be responsible for the protection of the museum. They will also learn about the depot and other parts of the museum that are not known to regular visitors.



11. A decision was also made to organize a meeting on the local level, for example with other institutions that possess CH objects (like the public library) with the firefighters in order to set a closer cooperation and priorities for joint exercises.

## II. 5 T4.1.5 Pilot action 5 - Emergency plans for heritage sites involved in Croatia

Pilot actions in the city of Kastela in Croatia took place on December 7, 2019. The main topic of the exercise was checking the suitability and effectiveness of the evacuation plan in an emergency situation - Evacuation plan for the Museum of the City of Kastela.

The organizers of the exercises defined as specific objectives:

- checking whether the museum staff and city services are familiar with procedures in case of immediate threat to cultural artifacts,
- checking the coordination of the relevant protection and rescue services,
- checking how successful the implementation of the existing evacuation plan will be.

The evacuation plan examines the readiness of competent and relevant services in case of natural disasters and their impact on cultural heritage. It includes assessing possible risks and consequences as well as defining the capacity and concrete measures for their implementation. The Headquarters for protection and rescue of the City of Kaštela is in charge for the development of evacuation plan The Headquarters coordinates all available flood protection capacities and provides material resources for flood protection (protective barriers, sandbags, etc.). In case of danger The Headquarters forms an intervention team to familiarize themselves with the current situation. The following units are then put on standby in accordance with the priorities identified:

- First priority: Volunteer Fire Departments Mladost, Gomilica and Kaštela, Facility for communal activities in the City of Kaštela. The Headquarters also activates and coordinates local organizations such as volunteer fire departments, local organizations for cultural heritage protection and religious organizations. In case of emergency, the Civil Protection Force will be activated. The tasks of the Civil Protection Force are to collect information on the functioning of the electricity, water and

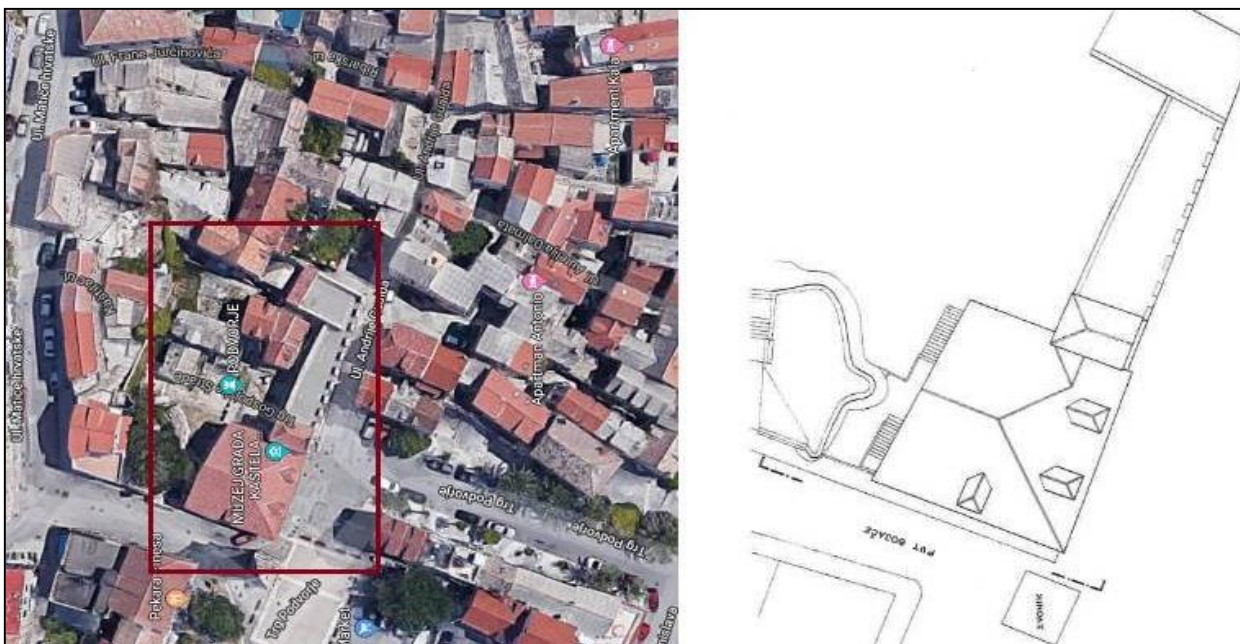


telecommunication systems related to the endangered infrastructure, and to collect information on road traffic. The Civil Protection Force then activates local volunteer fire departments, which jointly analyze the current situation and with a view to the extent of the damage, decide on the extent of protection and rescue measures. The Facility for communal activities in the City of Kaštela is in charge of integrating all available human and material resources in flood protection, rehabilitation of areas, sand removal, cleaning of public areas etc. Considering that the evacuation plan is being implemented in the area of protected cultural heritage, it is necessary to involve relevant experts in the field of protection and rescue in this process. This is the responsibility of the Special Purpose Civil Protection Unit of the Split-Dalmatia County - Water Rescue Team. This team is responsible for protection of the population, animals and material and cultural assets against the water. In this case, the protection and rescue refer to movable heritage that is stored in the Museum of the City of Kaštela.

Given the geographic position and the climatic characteristics of cultural heritage in the spatial scope of the project, the most prominent scenarios of threats are: floods caused by tidal waves, and streams caused by intense precipitation as well as fires that are common in this part of Dalmatia in the summer months. Due to heavy rainfall, there is a risk of dry watercourses spreading on the slopes of Kozjak. In addition, another threat is “Jugo”, the wind that blows from the sea to the mainland, raising the sea level and causing the flooding of the waves to the area covered by the plan. Fire due to drought is an equally important danger to be prepared for. Although the outside walls of the protected buildings are firm stone, other construction elements are made entirely from wood. During the summer in the situation with lack of rain and high temperatures wooden infrastructure is most vulnerable to fire. Fires spread over a short period of time by vegetation and strong winds that make it difficult to control it. In such conditions, fires can quickly spread to urbanized parts of a settlement where cultural heritage becomes potentially endangered. The main threat in such conditions is collapsing of wooden construction holding roof or staircase causing casualties and endangering stability of the building which in the end, threats do destroy valuable historic site.

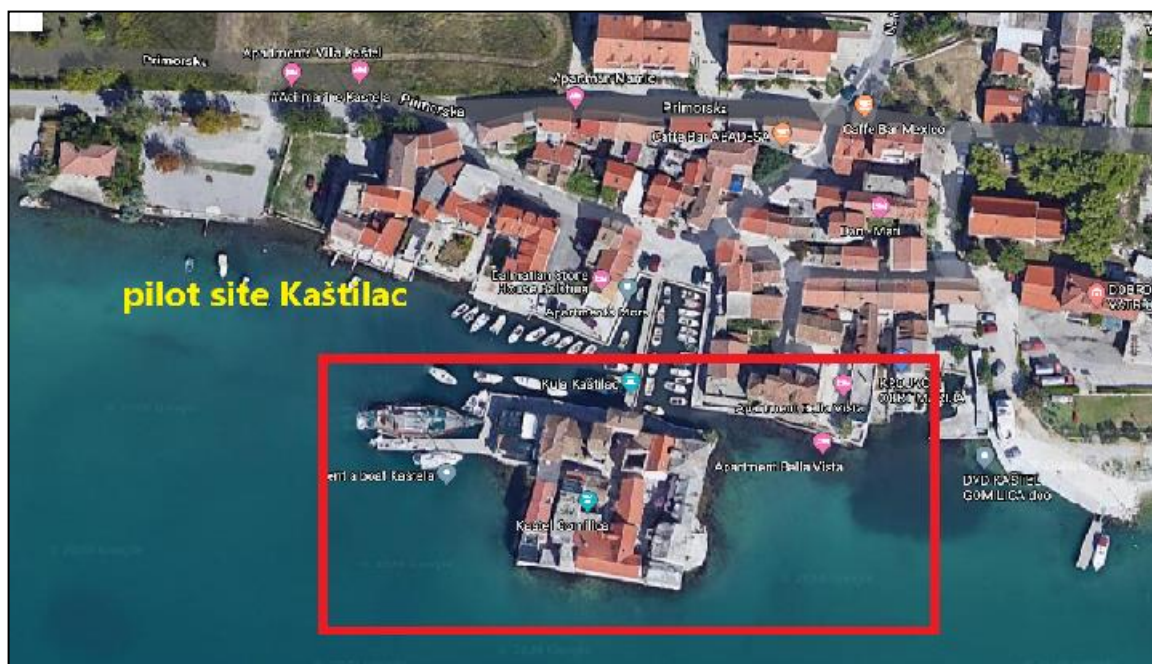
Pilot actions were carried out in two places:

1. Kastel Sucurac - Muzej grada Kastela - the building has 3 floors above ground with one emergency exit.



Sketch 6. Situational area of the exercises in Croatia, Muzej grada Kastela - heavy rain.

2. Kastel Gomilica - the historic part of the city, in which there are buildings with a diversified number of above-ground floors, however not more than 4. Due to the narrow streets, access to emergency services with specialized equipment is limited.



Sketch 7. Situational area of the exercises in Croatia, Kastel Gomilica - fire due to drought.



In the conducted exercises, two pilot variants were considered. Rescue operations were carried out in two separate places to check the effectiveness of the previously defined evacuation plans based on ProteCHt2save's Transnational Strategies for Cultural Heritage Protection in Emergency Situation in Climate Change in different spatial and temporal conditions.



The first part of pilot action was exercised at the Episcopal Palace in the historic center of Kaštel Sućurac where the Kaštela City Museum is located. The main threat was heavy rain, as a result of which large amounts of water flowed to Kaštela from the Kozjak slope. The danger of flood is further reinforced by the powerful Jugo wind that blew from the sea to the mainland, raising the sea level and causing the waves to flood the area covered in the plan. Large amounts of water without an adequate drainage system are rushing through stone streets of the old Gomilica and Štafilić reservoirs and outstretching into the buildings. Due to the large amounts of water in the basement and the ground floor of the museum, there was a risk of destruction of the movable cultural heritage located in these parts. The Head of the rescue action decided to evacuate it to a safe place agreed upon with the security office. After the evacuation operation was completed, firefighters started pumping out water from the basement and the museum's ground floor. At the end of the activities, the Head of the rescue action and the conservator identified the threat to other floors.

The second part of the exercise took place in Kastel Gomilica. Rescuers exercised preventive measures in case of fire due to drought. The fire started in an inhabited, protected urban area. After reaching the scene, the emergency services began to carry out the fire fighting action in order to minimize the impact of fire on wooden infrastructure and possible spread of fire. The fire was limited to one building with injured citizens. Due to the fire at the entrance to the facility, a fire boat was used to extinguish fire from the sea. After putting out the fire and evacuating the injured persons, actions are taken to protect the rest of the building and care for the injured. Then, the Rescue Operation Manager determines the condition of other buildings in the



area directly affected by fire and water used in the fight and the threat to the immovable cultural heritage.

All local emergency services, mainly fire brigades and the Civil Protection Force of the City of Kaštela, association of local population for the preservation of cultural heritage "Podvorje" from Kaštel Sućurac, were invited to both pilot sites. In total, 266 people took part in the rescue and evacuation operations. The rules of evacuation procedure were applied correctly in the exercises. Those at risk always have priority, followed by



the evacuation of the cultural heritage being at risk. While evacuating objects and elements of cultural heritage, conservation decisions regarding the order of their rescue were considered. First, property with the highest protection status was evacuated and secured.

After analyzing the pilot actions carried out, it was found that:

1. The evacuation of historic property was carried out in the expected period of time with positive results.
2. Head of Rescue Operation correctly prioritized operations.
3. The assessment of the object being at risk is very important in the planning and implementation of the evacuation. In determining the status of the site, the experts and competent services in charge of the evacuation have the most important role.
4. Poor condition of the urban infrastructure has been identified in this area, which makes it difficult to regulate precipitation, especially when it is intense and happens in a very short time. Therefore, due to its location, the area of the museum is also threatened by floods caused by torrential flows that are a result of intense rainfalls.
5. The assessment of the location was of particular importance in case of the evacuation of the Kaštilac fort located on the islet, since the entrance to the fort was only possible via one bridge. In this case, it was necessary to determine the condition of the site, and based on that, to define further actions and activities within the implementation of the evacuation plan.



The fortress located on the island requires more complex protection and rescue operations, especially in the case of the evacuation of people.

6. Each evacuation plan should include:
  - site assessment,
  - vulnerability of the area,
  - procedures specifying activities related to the implementation of the evacuation in accordance with the situation.
7. A team of experts should be created along with competent operational forces that will participate in the evacuation, as well as the superior managers who will be in charge of the plan implementation. The team of experts, together with the Head of Rescue Operation, will define all actions and determine the services that will be in charge of implementation based on a predefined situation.
8. The evacuation plans should include all potential risks that may arise in a particular area. Given that the City of Kaštela represents a highly endangered area from several potential risks, it is necessary to include implementation measures and activities as well as competent services in the evacuation plans for Cultural Heritage sites in the area of the City of Kaštela in the case of occurrence of any potential risks.
9. It is necessary to prioritize all endangered objects in the facility,
10. Detailed guidelines for carrying out the protection and rescue process should be defined.

## II. 6 T4.1.6 Pilot action 6 - Emergency plans for heritage sites involved in Hungary

The Hungarian partner of the project organized a pilot action in the center of the city of Pécs at the historic buildings of Cella Septichora and Zsolnay Museum. The main purpose of the conducted exercises was checking the suitability and effectiveness of the evacuation plan in emergency phase - Fire and Technical Rescue for the above-mentioned facilities. The plan described above, contains information on the basic characteristics of the museum building such as: address, contact details for managers, information on ownership and statistics of visitors. The plan also includes data on the demand for rescue forces and resources in the event of firefighting operations carried

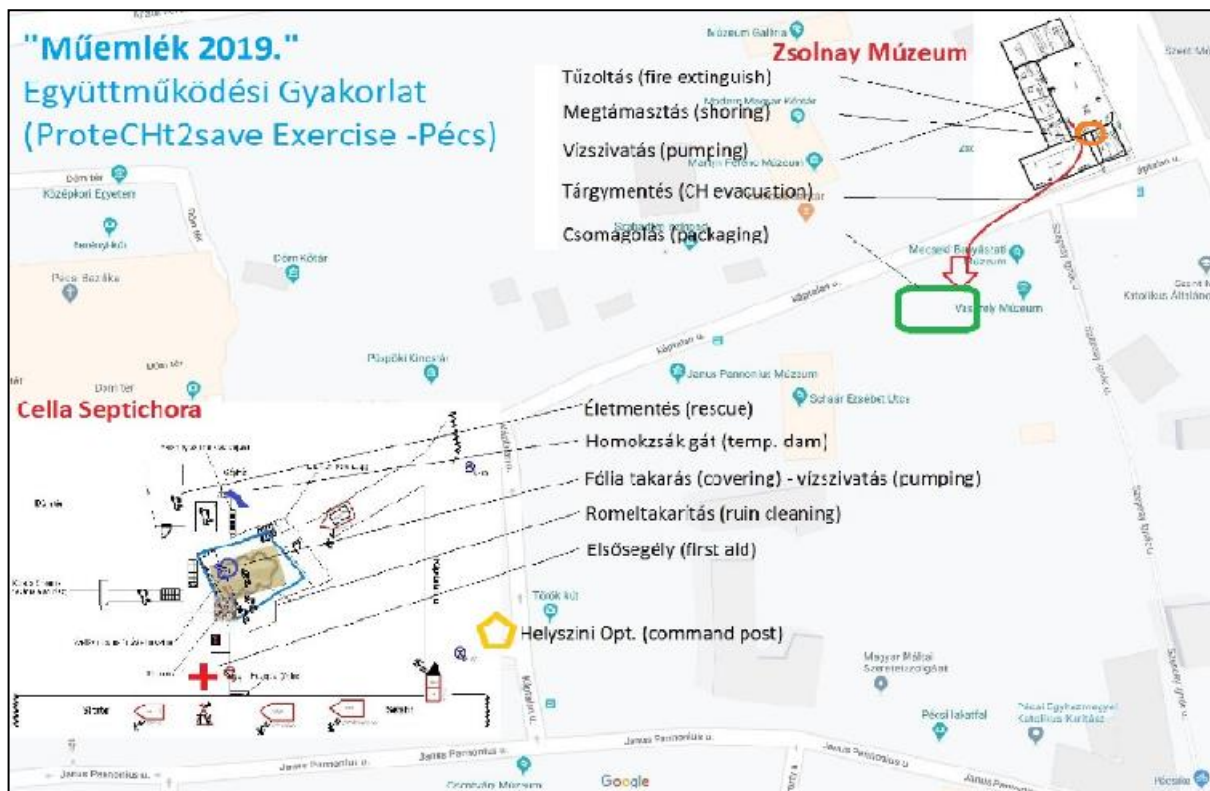
out in the facility, as well as basic operating procedures in the event of crises such as floods, fires and any other situations in which life and property protection occurs.

As part of the specific objectives, the following were checked:

- level of knowledge of procedures of the command members,
- level of cooperation of intervention units,
- defining the capabilities to be developed by noticing deficiencies and shortcomings in cooperation between departments, knowledge of procedures by responsible persons, etc., and striving to improve them.

An episode of organized exercises is planned considering the occurrence of flood risk in areas of CH. Rescue actions were taken simultaneously in two pilot sites:

1. Cella Septichora - building with 3 floors, including 2 underground with 3 emergency exits from the facility.
2. Zsolnay Museum - building with 4 floors including 1 underground with 3 emergency exits from the building.



Sketch 8. Situational area of the exercises in Hungary - flood.

The scenario assumed the emergence of a flood threat due to heavy rainfall. The cultural heritage area was affected by stormy winds and heavy rain. Cella Septichora is damaged due to heavy rain. Water leaked through the damaged parts and



flooded the exhibition area. In the Zsolnay Museum part of the building - the walls are flooded and on the roof structure fire arises due to the lightning. After the arrival of emergency services at the scene, the reconnaissance was carried out, the Head of Rescue Activities decided to carry out protective measures at Cella Septichora and evacuate the Zsolnay Museum.



There was a small group of guests in Cella Septichora before the event. The main task during pilot action was to evacuate them and provide first aid to victims. In addition, actions were taken to protect cultural heritage by building a dam from sandbags and by pumping out accumulating water on an ongoing basis. At Zsolnay Museum, the

primary tasks were to prevent the spread of fire and to start evacuating historic movable property. The head of the rescue operation properly informed the local conservator of monuments about the implemented evacuation activities and asked for support. The movable cultural heritage has been moved to a safe place and prepared for transport. Simultaneously with the evacuation, firefighting activities were carried out and loose wall structures were strengthened for the safety of rescuers. In addition, as a result of firefighting and heavy rainfall, the water got into the basement of the building, which meant it had to be pumped out.

The scenario of the pilot action had a very extensive character. He assumed rescue proceedings both in the event of a flood and during a fire. An additional difficulty for the emergency services was the evacuation of historic property. Each of the situations described above has different characteristics and requires the participation of a large number of qualified rescuers. The rescue tasks were conducted by specified professional (state) fire brigades, Volunteer rescue teams “Mecsek Mentőcsoport”, police, Security guard of threatened facilities,







Facility managers, employees of Disaster Management Department and rescuers University of Pécs. In total, over 100 people took part in active rescue operations. Eight different rescue and fire-fighting cars with specialized equipment were used, as well as boxes, sandbags, protective plastic foil and a shawl board. Activities were managed by an authorized fire brigade commander in cooperation with the Disaster Management Operational Service (KMSZ).

Separate theoretical exercises were carried out before pilot action in the area of historic buildings. Representatives of organizations and services participating in planned rescue tasks took part in the exercises.

The organizers of the pilot actions drew the following final conclusions:

1. There is no obligation in Hungary to create crisis plans for the protection and preservation of Cultural Heritage. Legal regulations should be changed, which will force a compulsory creation of such plans for each historic building.
2. Cooperation between the rescue entities participating in the exercises and the command teams was good.
3. Organized exercises gave the opportunity to managers of facilities for real cost planning for conservation activities.
4. Tasks for volunteer forces during rescue and evacuation operations are not standardized. They should be specified in detail.
5. During the exercise the police closed the area. They performed a diversion of traffic and provided the security and protection at the temporary storage site of the recovered artifacts. However, they could not take part in the rescue operations as the liability insurance of the police does not include highly valuable assets (in case of incidental damages during the rescue operation).
6. The training curriculum of firefighters and volunteers does not contain topics regarding the recovery procedures for CH. It is necessary to include them in the procedures of the museum institution in the course of informative training, exercises and providing the knowledge of the given site.
7. The regulations containing the nationally unified rules of rescue organizations (Firefighting and Technical Rescue Regulations) do not contain the tactical rules and the rules of rescue operation organization concerning the recovery of CH (not even at the level of recommendations).



8. It is necessary to improve the communication between the volunteer units, museum employees, civil organizations and other professionals (recommended radio traffic plan).
9. Protective clothing, protective equipment and markings are necessary for the employees of museums institutions.
10. The fire engines can only contain the uniformly packed equipment, they cannot include any equipment, materials necessary for the recovery of CH. These must be kept on stock and are accessible by the manager of the site in a way, that the responding forces can immediately gain access to them (packaging, storage and binding equipment, record sheets, etc.).
11. At the damage site there is no authority supervision (in Hungary) during the rescue operations - an amendment of legislation is necessary to determine the public powers.
12. The buildings are not fitted with the blue and white CH logo (as defined by the Hague Convention). It is necessary to mark them correctly.
13. The rescue plans do not list the objects to be rescued in hierarchical order - the rescue plans must be prioritized in advance.
14. The placement conditions of the objects exhibited, stored in the institution should be changed ("recovery-friendly" viewpoint)
15. It is necessary to develop the way of the swift documentation of the recovered objects (handling plan - inventory).
16. Due to the large number of participants and the complex nature of the rescue forces, the security officer was not able to follow the register of the persons entering and leaving the damage site. An appropriate procedure should be introduced to secure the facility against the entry of third parties (e.g. thieves).

## II. 7 T4.1.7 Pilot action 7 - Emergency plans for heritage sites involved in Poland

The main topic of the exercises carried out in Poland was checking the suitability and effectiveness of the evacuation plan in emergency situations - Rescue Plan for the Bielsko District and the city of Bielsko-Biala. A sham rescue and evacuation operation were carried out at the Church of the Exaltation of the Holy Cross in Stara Wies in the

commune of Wilamowice in the Bielsko District. The historic wooden church was built in 1522 on the slope. It is surrounded by a historic cemetery and an old school building from 1787.

The specific objectives of the pilot action were:

- assessment of the degree of preparation of fire protection units and other services and entities cooperating during rescue and firefighting activities;
- assessment of the degree of preparation of fire protection units and other services and cooperating entities in the need to evacuate the movable cultural heritage;
- improving cooperation and exchange of information between practitioners in the field of liquidation of the effects of threats, the possibility of evacuating people and property, including movable cultural heritage;
- improving the cooperation of the national rescue and firefighting system with services, local authorities and entities responsible for safety.



Sketch 9. Situational area of the exercises in Poland - heavy rain.

A rescue plan that is being tested in practice, sets out the tasks for rescue and cooperating entities as well as the order of actions and early alerting systems. It is being developed in the event of unforeseen circumstances and emergencies. It describes who, what and when will be done, with what resources in a given period of time of crisis. The development of a rescue plan is preceded by an analysis of threats that may occur

in the Bielsko District and the city of Bielsko-Biala as well as existing operational security.



Exercises were conducted on September 30, 2019 in the afternoon. The scenario of the event concerned activities carried out in conditions of intense rainfall and strong wind. Due to heavy rain, there was a risk of water getting into the historic church. Fire brigade intervention was necessary. During the flood control

activities, the church was damaged due to weather conditions. After the on-site examination, it turned out that there was a risk of flooding 14 historic paintings. The head of the rescue operation decided to evacuate them and disposed of the necessary forces and supportive measures to carry out further activities. The activities were managed in cooperation with the parish Head-Priest who was in charge of managing the parish, and in addition an administrative conservator of monuments was requested to support all actions. Then, the Rescue Operation Manager, designated the concentration point for the rescue services in the parking lot down the church, defined tactical tasks for existing firefighters-rescuers, and appointed people to evacuate the movable cultural heritage from the church. The entire process of evacuation of historic property was carried out in a coordinated manner involving all cooperating services and representatives of the parish council who are responsible for protecting the historic property of the parish. A special point was created in the parking lot in front of the church to secure and segregate the evacuated property. Due to the existing danger, only the firemen entered the church building, who after initial protection of the paintings, evacuated them to a point adapted in







the car park. There, representatives of the Parish Council were responsible for accurate protection and preparation for safe transport of movable artifacts.

In total, 9 special rescue and fire-fighting cars with 43 crew members from 7 fire brigades were assigned to the exercises. In addition, members of the Parish Council and a police patrol participated in the exercises, which secured the area of operation and managed the traffic.

After analyzing the exercises, the following final conclusions were drawn:

1. The unique character of the historic church in Stara Wies and its location on the hill proves that rescue operations should be carried out with increased potential of strength and resources. In addition, the facility administrator should have a permanent reserve stock of boxes and containers to secure movable property of cultural heritage in the event of evacuation.
2. When conducting evacuation activities, rescuers should receive from the facility administrator instructions in which the order of evacuation of historic property is given, considering their cultural value.
3. Exercises are necessary for efficient and effective evacuation. Despite the best plans, evacuation will not go smoothly if the rescuers are not trained and prepared to conduct such activities. Therefore, cyclical evacuation exercises should be organized for people directly involved in conducting evacuation activities.
4. The nearest local rescue unit - the Volunteer Fire Brigade in Stara Wies should be equipped with a permanent supply of flood sleeves to protect the sacred building from water at the hill side in the event of a flood.
5. Each historic object should have an individual rescue and evacuation plan as the basic document for conducting a rescue operation.

### III. FINAL CONCLUSIONS AND EVALUATION OF PILOT ACTIONS

Performing the tasks of the ProteCHt2save project of the WP T4.1 group, each of the project partners carried out practical exercises at the site of their pilot site, following the strategies for the pilot sites developed in WPT3, which were to be put to a test in the pilot actions of WPT4. Exercises were divided into two groups. The first was to check



the application of preventive measures in the areas of cultural heritage in the event of flood, fire due to drought and heavy rainfall. The second one was to test evacuation plans in crisis situations in the areas of Cultural Heritage in the event of floods, fire due to drought and heavy rainfall.

The analysis of existing crisis management plans and strategies for emergency preparedness regarding cultural heritage objects in Central European countries showed loopholes in legal regulations. There is a huge variety of legal regulations related to the creation of the above-mentioned documents. This diverse state-of-the-art in the individual partner countries is highlighted in detail in D.T3.1.1, the Report on Analysis of existing Plans on managing Cultural Heritage in Emergencies. Based on the analysis of pilot actions carried out as part of the T4.1 group - Testing and implementation at pilot sites, one basic conclusion can be drawn - legal regulations should be changed so that they require the creation of plans for the protection of cultural heritage in the event of emergencies.

In the current conditions, not every Central European country has an obligation to create plans for the protection of Cultural Heritage in the event of a crisis, and in some it is only necessary in the event of fire or flood. In addition, in the central european countries that have regulations regarding advanced conservation plans, there is no control of their implementation, therefore many facilities, despite the relevant regulations, still do not have protection plans. Lack of appropriate regulations and their enforcement is definitely unfavorable for the safety of historic buildings. Such a situation poses a real threat of serious value impairment at the time of the occurrence of crisis events.

Plans to protect monuments in the event of a crisis should be developed in the event of unforeseen circumstances and urgent events. Their purpose should be to prepare a course of action in a situation where the agreed procedure has been unexpectedly disturbed and has ceased to meet unexpectedly changed conditions. The plans should contain information about who will do and what and when will be done, by what resources and on what legal basis - before, during and immediately after the crisis event, as sketched in the readily adaptable D.T3.1.2 Transnational Strategie and Implementation of existing Plans in Preparation to Emergencies. Creating plans for the protection of monuments in the event of crises should be preceded by an analysis of the threats that may occur in a given area, considering geographical location, population



density, infrastructure and threats from neighboring areas. In addition, the plans must contain information about what historical objects are in the area, what are the ways to protect them, what equipment and material is needed for protection, who is responsible for its delivery, for evacuation and transport of artifacts. A map of the location of historic objects with evacuation routes is a must. Only a plan structured in such detail, agreed with all rescue entities, can guarantee the proper preparation and effective conduct of rescue operations in the event of a crisis.

Another key element affecting the success of rescue and evacuation operations is the possession of specialist knowledge by the persons who will be responsible for conducting these activities. Based on the analysis of the pilot actions carried out, the need to organize training in the field of protection and evacuation of historic buildings for rescuers and local people was found. It is the local population and the nearest emergency services that will be the first forces available to assist in evacuation operations. One should strive to broaden knowledge in the field of protection, transport, security and evacuation of historic property. In addition, cyclical practical exercises should be carried out on the evacuation of a historic building or building containing historic exhibits with the participation of rescue services. Only a practical exercise of evacuation will give the opportunity to familiarize the rescuers with the area of operation, and supervisors will gain knowledge about the weaknesses of the facility, training of rescuers, necessary organizational changes and the time, equipment and number of rescuers needed to carry out fast and effective actions. Appropriate training and exercises are the basis for the security of cultural heritage. Therefore, one should strive to introduce appropriate legal regulations obliging to carry out such activities periodically.

Each of the 7 organized pilot actions was prepared in a professional manner and involved rescue units to take appropriate action. By properly preparing and testing existing evacuation plans for emergencies and a preparation strategy, each of the ProteCHt2save project partners obtained reliable information about their effectiveness, shortcomings, and changes necessary to better protect cultural heritage. The conclusions drawn from the analysis of the exercises carried out regarding the differences between the planned activities and the work actually understood by rescuers and supervisors will contribute to the development and improvement of protection to Cultural Heritage.