WALPHY PROJECT : summary

The Walphy project is linked to the implementation of the EU Water Framework Directive (DCE 2000/60/CE) that requires that surface waters in all member states reach the “good ecological state” by 2015 (European Commission, 2000). The main aim of the Walphy project was to set up a concrete methodology that could be applied in Wallonia, to help define the restoration works to be undertaken to improve the hydromorphological quality of water masses most “at risk of not reaching the good ecological state” within the upstream section of the Meuse catchment. The general outline of the Walphy project, and the articulation of the various actions, was defined in the most coherent manner possible. It is based on (i) preliminary studies aimed at selecting those water masses that require intervention; (ii) a diagnosis of water masses that helps defining and locating the best sites for these interventions; (iii) a series of guidelines that help planning and carrying out the restoration works, and (iv) a monitoring based on pre- (initial state) and post-work surveys. The methodology was applied on three water masses: the Eau Blanche (MM05R) and the Bocq (MM28R and MM30R), this in order to draw observations that could be used at a larger scale, in various types of water courses, and for a variety of techniques that could be used. The methodology has been summarized in the technical guide (action 9).

Action 1, setting up a website for the project, has made it possible to report on the results of the project, hence ensuring its visibility. The general public, as much as specific actors of the project (managers, scientific partners) is targeted by this website, whose contents are updated every 3 months on average.

Action 2 has made it possible to setup a methodology for identifying works to restore hydromorphology.
Among the various methods listed, “Qualphy”, a methodology designed and developed by the Agence de l’Eau Rhin-Meuse (Rhine-Meuse Water Agency, France) has proven the most adequate tool. It is based on 50 parameters and proposes, beyond a global evaluation, a compartment-based evaluation for the floodplain, the riverbed and the river banks. The methodology has been subjected to numerous modifications, both on matter and manner, and additions were made related to physical aspects (evaluation of riverbed clogging, estimates of water course dynamics and specific power). An updated notice has been proposed listing all these modifications.

For **action 3**, the method developed in action 2 was applied to two of the water masses under study : the upstream part of the Bocq (MM28R) and the downstream section of the Eau Blanche (MM05R). The third water mass we had selected (MM30R, downstream section of the Bocq) had already been subjected to an evaluation by S. Van Brussel in 2005. The evaluation of physical quality on both these water masses followed a stepwise process: identification of water course typology, definition of homogeneous “sectors”, field measurements, data encoding and analysis of the results, this in order to identify those sectors where the restoration works would then be undertaken (actions 4 and 5). The method also made it possible to identify those compartments where most problems were encountered (floodplain, riverbed, or river banks). Those results were mapped in connection with a GIS type database. The conclusion from the use of that method is that it is particularly well suited to a diagnosis of water masses. It identifies those sectors and compartments that are most degraded. This body of data provides invaluable help to managing authorities when they must devise their interventions, define priorities, and plan the works.

Action 4 focused on restoring water courses on the longitudinal axis. Along the three water masses selected in action 3, a total of 27 obstacles to longitudinal continuity were studied. These studies defined, for each obstacle, a series of possible scenarios for modifications. During the study, meetings were held with the owners of each of those installations (action 6), which sometimes led to abandoning some, - or proposing alternative-, technical options. The various proposals or scenarios

were then compared and evaluated following a multi-criterion approach. By the end of the project, an agreement was reached between all parties (action 6) on 23 of the identified obstacles (plus 1 on the Eau Blanche), the legal permits and authorizations were secured from the administrations involved (town-planning administration, provincial government), and public bids for proposals were launched following the legally-approved procedure. The technical solutions retained varied largely. Eight installations were completely suppressed, 6 bypassed by digging side-arms, and 3 pre-dams, 2 wrinkled ramps, and one multi-basin pass were constructed elsewhere. Finally, a combination of two differing techniques was used on the last three sites.

In **action 5**, restoration works focused on the transversal dimension. As expected, the downstream stretch of the Eau Blanche (MM05R) was the most impacted water mass, comprising some 44 % of all the restored sections, whereas 38 % of restoration works were carried out on the upstream stretch of the Bocq (MM28R), the remaining 18 % on the downstream stretch of the Bocq (MM30R). The choice of sectors to be restored was made by crossing the results of the evaluation of physical quality (action 3) with an historical analysis of alterations to the course of the river (ancient lies), their location along the catchment (as priority was given to downstream sections), and following the meetings we had with all landowners concerned (action 6). On the selected sectors, the type of restoration to be applied (diversifying flow, re-meandering, etc.) and the nature of the works undertaken varied substantially again, as each situation was particular. In total, a linear section of some 22.06 km was restored entirely (the total was computed on the basis of the length of restored sectors as surveyed by Qualphy). An analysis of associated costs was conducted for actions 4 and 5. This analysis was conducted to serve as a guideline for those authorities that could, in the future, be involved in actions similar to those described here. At present, it is not possible to undertake a true cost/benefit analysis of the works, because it would ask for developments that lie beyond the scope of the project. Furthermore, it is premature to evaluate the ecological benefits of these works only one to three years after they are completed.

Action 6 relates to consulting local stakeholders. Its aim is to enable the finalization of actions 4 and 5. The ins and outs of the project are explained in order to secure the agreement and participation of all those parties involved that can exercise objective rights.

For **action 7**, the geo-morphological survey, we started by completing a diagnosis of water masses before any restoration was projected: characterization of water masses from the outlook of their geo-morphological parameters, and balance of the various pressures. Several methods were tested for this monitoring. Some of them, ill-suited to the project from the start, were rapidly set aside. Others, more conclusive, were applied on location. Their use made it possible to follow the modifications of morphology in restored sites. For example, when the outfall of Spontin was demolished, we were able to show that the natural transport of sediments had been restored, and to characterize the evolution of flow patterns that define aquatic habitats. This monitoring also included an analysis of sediment transport, clogging of the riverbed, and the effect of spates on the works.

The ecological monitoring (**action 8**) is linked to actions 4 and 5. It comprises a pre-work phase needed to obtain a precise description of sites before any intervention is undertaken. A second phase then aimed at monitoring the evolution of ecological quality after the interventions were completed. The methods used focus, aside from water quality itself (SEQ-Eau), on hydromorphological quality (microhabitats, indexes of physical quality) and biological quality (macrophytes, macroinvertebrates, fishes). Overall, the use of those methods on the various sites provided encouraging results, among which the swift response of fish populations to the creation of spawning areas or hiding places was most spectacular. However, water quality should reach a sufficiently high level to ensure that the benefits of restoration are optimal for the aquatic organisms and ecosystem as a whole. This is at times still problematic on the Eau Blanche. We can nevertheless conclude that hydromorphological restoration is an indispensable tool to reach the good ecological state of water masses. In that

aspect, it is completely in line with the objectives of the WFD. Habitat heterogeneity was enhanced, which improved the biological response in most cases.

In **action 9**, a technical guide was drafted to report on the works undertaken during the project, and distributed to the managing authorities of the various water courses. This guide includes a description of the methodology followed that led to the restoration works, from the selection of sites to the definition of methods, as well as 9 sample cards each describing one working site.

In the framework of **action 10**, a colloquium was organized between October 15 and 17, 2013 at the Palais des Congrès in Namur, around the topic "hydromorphological restoration of water courses: first lessons of the Walphy project". This international gathering of some 210 participants was a platform to report on the results of the project, and an opportunity to share them with similar experiences from other countries.

The pedagogical trail (**action 11**) aims at following the restored sector at Nismes on the Eau Blanche. It has been installed along the river to inform on a significant series of works undertaken there. Six panels are installed that aim at explaining the works undertaken in relation to the flora and fauna. The trail was opened on September 6, 2013 when children from the 5th and 6th grades from the public primary school in Nismes participated. In parallel to the trail, various associated documents were produced: a folder on the project (3000 copies, a map of the trail (300 copies), a pedagogical portfolio (50 copies), a report to the general public (translated in English), a workbook for teachers, and a press file.
As a complement to our aims of circulating results it is worth noting that, aside from the vulgarization we just evoked (the trail and associated documents, visits onsite), scientific reports and publications have been produced. Numerous presentations have been given, and posters presented, during international and national scientific events. The long-term benefits of the project are measurable in terms of the length of river that has been restored. As far as longitudinal continuity is concerned, this gain can be equaled to the length of river that is now free of any obstacle: 16,640 m along the Bocq are now entirely connected to the Meuse. Also, in the middle section of the catchment, a network of some 28,950 m of river, including the Bocq itself and two main tributaries, the Leignon and Petit-Bocq, are today free of obstacles.
To further widen our audience and improve the distribution of results, a short documentary film was shot on the project, directed by a team from the SAVE (audio-visual service) of the University of Namur.

The environmental benefits along the 22 km of river where transversal continuity has been restored (along the Bocq and Eau Blanche) is translated into a series of indexes, and biological and hydromorphological indicators, as underlined in actions 7 and 8.
Planning this project also led to reclassifying the water masses of the upstream (MM28R) and downstream (MM30R) stretches of the Bocq into the category "natural water masses". It is at present impossible to predict the eventual impact of the works on the status of these water masses. The monitoring of biological indicators, especially those based on fish populations, at the scale of the entire water masses will be, in the near future, analyzed in close connection with the benefits of this action.