



LIFE06/ENV/IT/255

**A.S.A.P.****Actions for Systemic Aquifer Protection**

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## ASAP Protocol – Step # 3 (draft)

*Actions for Systemic Aquifer Protection - Implementation and demonstration of a Protocol to scale down groundwater vulnerability to pollution due to overexploitation*

**(Rev. 1a)**

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the European Commission and to selected Water  
Professionals and Scholars

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### (i) Thanks

- 5 Without the co-financing of the European Community LIFE Program it has not been possible to start the generalization and validation job of the ASAP project approach for its diffusion and re-use.

The team availability of external monitoring has been a jewel help.

- 10 This work has been possible thanks to the availability and collaboration of all the ASAP Project Team.

The active share, availability, professional quality of all the involved subjects have allowed to start the editing of the ASAP protocol, of which this document represents the first section in draft.

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(ii) Summary

1 Introduction of the methodological aspects.....	10
1.1 Measuring campaign.....	10
1.2 remote control of sensitive knots.....	11
1.3 Constant calibration.....	12

### (iii) Purpose of the document

This document is the draft version of the A.S.A.P. Protocol **third** step.

20 The proposed model uses the protocol that Acque Ingegneria - in collaboration  
with the project A.S.A.P. partners - has introduced in the LIFE project "A.S.A.P.  
Actions for Systemic Aquifer Protection", contract LIFE06/ENV/IT/255, that the  
European Community has co-financed in 2006 and dedicated to the interventions  
25 losses search.

The project has a total value of about 2,5 million of Euros, it begun in 2006 it has  
an approximate 36 month duration.

Major information about the project are available in the web sites  
30 [http://ec.europa.eu/environment/life/infoproducts/lifeenvcompilation\\_06.pdf](http://ec.europa.eu/environment/life/infoproducts/lifeenvcompilation_06.pdf) and in  
the project development to the URL portal <http://www.klink.it/gate/asap>.

The A.S.A.P. project Actions for Systemic Aquifer Protection consists on the put  
in work and demonstration of a Protocol to reduce the stratum vulnerability to the  
pollution caused by the great exploitation.

35 Among the project objectives, in an ample perspective at community level, there  
is the availability of a protocol, of drive lines and of a demonstrative site to the  
aquifers protection, the demolition of the capitation levels, the distribution  
systems of drinkable water in normal conditions optimization.

The A.S.A.P. Protocol documentation has been planned in three steps  
40 (correspondents to other three phases / task of the work plan) in order to allow its  
verification in the field.

The three principal steps of the protocol are:

- acquisition of the system knowledge on which they intervene;
- net optimization and collecting demolition;
- **definition and progressive approach to the optimal management level**  
45 **(minimum collecting sufficient).**

Every documented step is compiled in draft form and it is putted in circulation  
between the project partners to the verifications, criticisms and suggestions.

50 The version obtained in this way is translated and putted at disposal in the  
project web site and it is presented to the examination by the community of the  
interested operators; nevertheless, it remains open until the document  
completion in all its three parts and to the final validation.

### (iv) Warnings

1. The authors of this document have tried, where it was possible, to use a  
55 comprehensible language for readers of different origins and users with  
different finalities, avoiding, where it was possible, the use of specific or  
sector terms; nevertheless, some technical aspects have necessarily  
asked for a sector language.
2. This document is in "draft" version. At the moment of its release as  
60 deliverable, it is circulating among the project partners for the harvest of  
suggestions, criticisms, contributions, before to be submitted to the partial  
validation. Therefore, its use in field should be postponed to the moment  
in which the whole protocol was available, *complete in all its parts and  
validated.*

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## 1 INTRODUCTION OF THE METHODOLOGICAL ASPECTS

65 The final objective of the A.S.A.P. protocol is the pressure reduction on the aquifer (and in general on the water reserves from which collecting are effected).

The pillars on which it is founded are the losses reduction and the optimal pressures management.

70 After the losses control (about which it has been discussed in the Draft I), the pressures regulation (about which it has been discussed in the Draft II) the subsequent passage regards the measuring and optimization phase.

### 1.1 MEASURING CAMPAIGN

75 In order to verify the net behaviour that follows each consumptions change related to the minimum course introduced in the net for sheltered losses or for the minimum pressure furnished to the contour they have to be realized some measuring campaigns which partially represent a measuring repetition effected with the initial zoning, if they are excluded the measures acquired with the remote control of the sensitive knots.

80 However, in this case the scenery doesn't show the initial uncertainty but it is based on measures effected on knots better structured for the manufactured articles presence adequately predisposed, even though the same, of those used for the zoning.

85 The measures repetition in just monitored places results more effective in the points where the valves have been realized because of in these points they are realized some affixes spaces on the conducts where they have to be effected the measures through ultrasounds instruments and contemporarily they have to be verified the fixed measurers precisions installed in series to the valves.

90 Possibly and to have the maximum precision on the internal diameter (setting parameter of the measurer ultrasounds) these predisposition will be realized with tronchets in inox steel with length of about at least 5 diameters and in any cases not inferior to 80 cm.

In the districts and in the sectors a series of contemporary pressure and course measures will be effected.

95 For the sector monitoring activities they should be employed equipped teams with at least:

- 8 course ultrasounds measurers
- 2 spessi meters
- 10 pressure measurers - data logger for the field data acquisition
- 8 portable peripherals for the data GPRS transmission

100 For the management and data analysis activities:

- 2 computers
- 2 fix placement complete of computer
- Specific software to the measure points and losses filing
- 2 digital cameras

105 Thanks to effected measures it will be esteemed for each municipality object of  
the intervention, the initial loss degree and they are indicated the water recovery  
achievable objectives.

The correct procedure foresees to monitoring the district behaviour and  
subsequently the sectors, in such way the complementary sectors consumptions  
110 can be determined for difference with the district consumption.

In order to value the real total loaded produced on valley by the valves will have  
to be measured with a precision of + /- 0.5 ms the real quota s.l.m. of the  
pressure taking point, also keeping in consideration some gradient between the  
campaign plan and the taking point.

115 Being an instantaneous balance finalized to the consumptions monitoring it will  
have to be realized a monitoring courses campaign for each incoming resource  
point, normally a reservoir, obviously also in cases in which there is not the  
pressure regulation through valves.

120 Elaborating the introduced courses it will be calculated the instantaneous course  
in the back state to the recovery actions as the sum of two variables, one tied up  
to the real users consumption, the other to the losses reduced by the  
individualize hidden losses value.

125 In the districts, where for definition there are some fix course measurers which  
can manage the instant consumption monitoring, the indirect measurements, or  
those realized automatically by the TLC while in the sectors it is necessary to  
handle direct measures, possibly repeating those of the initial zoning with the  
purpose to have the greatest possibilities of comparison. This last activity uses  
measuring instruments not invasive, such as portable or ultrasounds ones,  
limiting at the minimum the installation of dissection rolling shutters.

130 The courses values, the pressure one and the others acquired data are  
memorized both in the field and they can also be transmitted through GPRS to a  
dedicated software which allows to execute algebraic sums in automatic way and  
consequently to determine the instantaneous course.

135 The measures have to come back in a format tractable by electronic  
spreadsheets (for example such as it can be seen – comma separated value)  
and for each value it will be returned a file constituted by at least three columns  
of the followings fields: date - hours: min - value.

140 For each value observed they should be calculated in automatic way the  
following variables with reference both to a single day and to the whole  
observation period:

- medium value;
- minimum value;
- maximum value;
- specific night time hours value (only for consumption curves)

## 145 1.2 REMOTE CONTROL OF SENSITIVE KNOTS

The remote control of the sensitive knots which is the control of the resource  
incoming points in the net and/or the control of the total load regulation can be  
realized through a suitable tele control system which is constituted by a  
peripherals fleet connected to the fittings which have to be checked and  
150 commanded, and by the whole of the consumers which keep and send  
information. Through the new interfaces integration for the hidden losses analysis  
and management among those ones eventually present in the tele control can be

monitored both the pressure and the courses or the district balance composition through an algebraic sum which considers the incoming and going out from a sector courses.

What is realized in every knot is the recording of every single component, both hydraulic and of system, with a temporal scanning of 5 minutes. Through the sensitive knots remote control it is possible to realize a graph which reproduces for each interval of 5 minutes the net consumption value (real losses + users consumptions), of the pressure, of the course, etc.; in order to allow a complete vision of the variation dynamics both of the consumption and of the losses, two specific interfaces will have to be realized:

1. graphic analysis of the night time characteristic value
2. graphic analysis of the daily instant value

In the first case, for each realized district, it has to be calculated and putted in a graphic the night time specific course value (medium value of the consumption calculated from 03:00 to 05:00 of every day) on temporal intervals of one day, one month, one year. In order to allow that the consumer could receive an alarm, in the case of an anomalous night time consumption, they can be inserted two thresholds of guard (in percentage on the medium value) which activate an alarm with a different priority to the respective overcoming.

Instead, in order to analyze the daily consumptions behaviour, or of the course which feeds the hidden losses and the users, it has to be realized a specific page of the district on which they have to be reported the incoming and going out courses values to the contour and the calculated value of the instantaneous district consumption, considered such as the algebraic sum of the incoming and going out courses.

All the data should be accessible with a simple internet connection from any mobile or fixed posting and the peripherals postings planning should be allowed from remote (previous qualification).

In order to have the maximum work autonomy on the water nets knots and in the distant positions from the inhabited centres, the peripheral could also be gifted of an alternative system of feeding with solar panel or with hydro turbine which exploits the jump produced by the valves (only for sensitive knots realized on regulation valves).

### 1.3 CONSTANT CALIBRATION

The mathematical modelling and the following setting executed considering the initial state, it allows the planning of the first interventions which have to be effected and the system answers evaluation in the possible sceneries.

The useful methods for the water losses reduction which have an impact in a brief and medium term on the recoverable water volume are the hidden losses reparation, and also the pressure regulation modulated in the time which will have to maintain unchanged the minimum level service value in the critical points.

The whole of these activities involves a substantial modification both geometric and of the hydraulic net behaviour and the consequent progressive removal between the initial model and the effective state.

In fact, with the losses reduction and with the pressure regulation they intervene both on the spatial consumptions distribution in a sector and therefore on the

200 courses circulation, both on the introduced water quantity making inappropriate the pattern used in the model previously set.

Considering the fact that the calibration executed minimizing the discard between the measured datum and the calculated one doesn't furnish an univocal combination of the system variables values (roughness and request spatial removal ) but only one of them, because of the incoming data don't coincide in number with the unknown ones, and it is necessary a new recalibration phase which furnishes a new combination of roughness and request distribution which made the model valid.

210 In this phase the cartography and the model can usefully be adjourned thanks to the information that will be acquired with the losses reparation or when it is discovered and it can be measured the conduct real diameter, the internal roughness and it can be valuated the constituent material.

215 Therefore, a second course and pressure net measurement campaign is necessary with the purpose to value the operation variations brought to the system by the interventions, in comparison to the preceding state.

Obviously, the single district data analysis has to return a generalized water consumption diminution, in particular way of the minimum night time value (Minimum night flow, QMNF) and the level service congruity with the objective of the effected interventions.

220 The elements which have to be inserted in the hydraulic model are the new request pattern discredited on a hourly interval of 5 minutes that allows us not to eliminate the consumption limits and if we perform the PDA analysis making reference to the water losses, the new K<sub>j</sub> coefficients of each knot calculated basing on the minimum night time analysis of the night time consumption.

225 The calibration is performed through a trial and error procedure, punctually comparing the course and pressure data measured in specific net points with those furnished by the model until the optimization of the same. The constant calibration at each conditions change to the contour and to the consumption, it allows to adjourn also the mathematical modelling in comparison to the setting executed considering the initial state.

The whole of these changes involves a substantial variation of the hydraulic net behaviour and the consequent progressive removal between the initial model and the effective state.

235 In fact, with the losses reduction and with the pressure regulation they intervene both on the spatial consumptions distribution in a sector and therefore on the courses circulation, both on the introduced water quantity making inappropriate the pattern used in the model previously set.

240 Considering the fact that the calibration executed minimizing the discard between the measured datum and the calculated one doesn't furnish an univocal combination of the system variables values (roughness and request spatial removal ) but only one of them, because of the incoming data don't coincide in number with the unknown ones, and it is necessary a new recalibration phase which furnishes a new combination of roughness and request distribution which made the model valid.

245 In this phase the cartography and the model can usefully be adjourned thanks to the information that will be acquired with the losses reparation or when it is discovered and it can be measured the conduct real diameter, the internal roughness and it can be valuated the constituent material.

250 Obviously, the single district data analysis has to return a water consumption variation, in particular way of the minimum night time value (Minimum night flow,

QMNF) and the level service congruity with the objective of the effected interventions.

255 The elements that modify the hydraulic model conditions are the new request pattern and the possible changes in the geometry (Diameters) and/or conducts roughness, the calibration files of (pressure).

The final objective of the calibration is that to minimize the discard between the minimum attended service level value and the diurnal pressure value or of that night time one.

260 The objective pressure value in the hydraulically more distant knot is the alignment between the night time minimum pressure and the minimum diurnal one.

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This document is available on the Internet at

<http://www.klink.it/asap>