Chapter 5
Water Abstraction Charges and Compensation Payments in Baden-Württemberg (Germany)

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Abstract This chapter analyzes the policy mix of economic and regulatory instruments introduced in the German state of Baden-Württemberg in order to address two key water management problems: excessive nitrate concentrations in groundwater and unsustainable water abstraction. Three different policy instruments have been applied: the Regulation on Protected Areas and Compensatory Payments (SchALVO) introduced in 1988 (a regulatory and economic instrument), water abstraction charges, and Market Relief and Cultural Landscape Compensation for farmers (MEKA), a voluntary instrument introduced in 1992.

The analysis of the policy mix shows the MEKA and SchALVO measures have been considerably successful in reducing groundwater nitrate concentrations. However, their success may have been higher if monitoring activities had been expanded and enforcement measures had been imposed. Water abstraction charges allow for the internalization of environmental and resource costs, but the compensation payments from the MEKA and SchALVO programs arguably contradict the "polluter pays principle", going against Article 9 of the Water Framework Directive.

Positive outcomes include the fact that transaction costs can be reduced by introducing joint applications for compensatory measures (e.g., for MEKA and SchALVO) and by harmonizing administrative procedures to already existing economic or regulatory instruments (e.g., the water abstraction charge was linked to existing procedures of the effluent tax).

Keywords Policy mix • Baden-Württemberg • Abstraction charge • Compensation payment • Amendments and exemptions • Negotiation

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M. Lago et al. (eds.), *Use of Economic Instruments in Water Policy*,
Global Issues in Water Policy 14, DOI 10.1007/978-3-319-18287-2_5

5.1 Introduction

In Baden-Württemberg, a *Land* (German Federal State) located in south-western Germany, problems relating to groundwater quality, especially high nitrate levels, have been known of since the 1970s. Since 2000, the overall objective has been to achieve "good ecological status" for all water bodies – following the goals of the EC Water Framework Directive (WFD) – and to reduce nitrate values at all measuring stations to below the threshold stated in the Drinking Water Directive, i.e. 50 mg/l by 2015. Prior to 2000, but still relevant, a long-term goal is that all water protection areas should be categorized as "low-risk zones" according to the EC Nitrates Directive (Landtag Baden-Württemberg 2008). Further, the *Länder* need to set provisions for compliance with Article 9 of the WFD on full cost recovery of water services.

This chapter introduces and evaluates the performance of the policy mix of economic and regulatory instruments introduced in Baden-Württemberg to address water management problems, such as high nitrate levels in groundwater. The policy mix consists of the following instruments[1]:

- Regulation on Protected Areas and Compensatory Payments (SchALVO)
- Market Relief and Cultural Landscape Compensation (MEKA)
- Water Abstraction Charges

5.1.1 Introducing the Instruments' Objectives

The objective of the SchALVO is to protect the ground and surface waters in water protection areas from agricultural runoff, particularly nitrates, pesticides and microbial pollutants. In addition, previously polluted water shall be rehabilitated (LTZ 2010). However, no quantitative targets were set with the introduction of the instrument. In addition to the SchALVO measures, the MEKA program was introduced in 1992 to cover ground and surface water bodies outside of water protection areas, and since 2001, those in low risk areas, which do not receive SchALVO compensations. Its objectives include the maintenance of the cultural landscape, support for the agricultural market, and the introduction of environmentally-friendly and extensive farming practices. As the environmental impact of measures covered in the MEKA programs are sufficiently documented, the targets of these programs are based partially on area-wide coverage and levels of acceptance, rather than on quantitative environmental goals (see Table 5.1).

While considerations to introduce the water abstraction charge started with the decision to introduce and need to finance compensation payments to farmers, such

[1] Regulation on Protected Areas and Compensatory Payments (Schutzgebiets- und Ausgleichs-Verordnung – SchALVO); Market Relief and Cultural Landscape Compensation (Marktentlastungs- und Kulturlandschaftsausgleich – MEKA); Water Abstraction Charges (Wasserentnahmeentgelten).

Table 5.1 Goals of the MEKA III programme

	MEKA III (2007–2013)		
	Plan 2013	2007–2009	(%)
# of farms participating	35,000	33,515	96
Area covered by MEKA (ha)[a]	1,520,000	1,548,430	102
Physical area covered by MEKA (ha)	900,000	864,616	96
Area covered by MEKA measures to improve water quality	500,000	2,962	59
EUR spent	657.1 million	295.7 million	45

Source: IFLS (2010)

[a]The area covered by MEKA measures exceeds the physical area of agriculturally used land, as one physical area may be supported by multiple MEKA measures

as SchALVO (Bergmann and Werry 1989: 2–4), the policy objectives of the water abstraction charge itself were focused on the following[2]:

- Despite the current water abundance in Baden-Württemberg, water shall be seen as a valuable resource by its users, as its current availability may be reduced in the future by competing uses and climate change-related impacts on hydrology (*awareness raising and precautionary principle*);
- As such, the water abstraction charge shall incentivize water-saving behaviour by its users (*incentive function*);
- Furthermore, the water abstraction charge shall reduce the economic advantage (*Sondervorteilsabschöpfung*) of agents that benefit from the abstraction of water in comparison to those that do not benefit from abstracting water (*competitive rebalancing*);
- The government of Baden-Württemberg invests substantially in maintaining and cleaning water bodies – costs which shall be internalised by the users (*cost recovery*).

As such, the policy objectives represent a mix between the incentive and financing function of the abstraction charge. Following the transposition of the WFD into German federal law, the water abstraction charge can be further seen as the implementation of Article 9 of the WFD. As with the SchALVO, no goals for reaching any of the specific targets of the abstraction charge listed above were quantified (Bergmann and Werry 1989: 7).

5.1.2 Introducing the Policy Mix

The SchALVO, which was introduced in 1988 and amended in 2001, curtails standard agricultural practices (*ogL*) in water protection areas. Water protection areas are divided into three zones in which the constraints on agricultural practices differ,

[2] See the legal text introducing the water abstraction charges (Landtag von Baden-Württemberg 1987) as well as in its amendment (Landtag von Baden-Württemberg 2010).

namely, Zones I, II, and III (Mader 2002). To optimise the incentive function and increase the effectiveness of the SchALVO, its amendment further classified these three zones into Low Risk, Problem, and Decontamination areas, depending on their nitrate levels in groundwater and mirroring the objectives of the EC Nitrates Directive (Table 5.2).

As such, the SchALVO now links the immissions and emissions of nitrate. Constraints on standard agricultural practices, as well as compensation payments and control mechanisms, are varying between areas (Table 5.2, LTZ 2010).

Table 5.2 Compensation payments, zone, and area classifications under SchALVO, from 2001

Zone/area	Low risk area <25 mg N/l	Problem area >35 mg N/l OR >25 mg N/l if over the past 5 years nitrate concentrations increased by >0.5 mg N/l	Decontamination area >50 mg N/l OR >40 mg N/l if over the past 5 years nitrate concentrations increased by >0.5 mg N/l
I (well head): only grasslands or forests are permitted; the application of fertilizers, plant protection products is banned	Compensation payments in zone I only in exceptional circumstances		
II (inner protection zone): in addition to Zone III, Prohibition of the application of manure and sewage sludge; prohibition of animal pens; limited manure spreading and grazing;	Compensation payment for Zone II is only made if the farm holds cattle and can be paid additionally to the compensation payments outlined for Zone II and III		
	Fixed rate (EUR/ha/year) in all areas based on % of agricultural land in Zone II		
	>20 % → EUR 10		
	20–30 % → EUR 40		
	36.50 % → EUR 85		
	<50 % → EUR 160		
II (see above) and III (outer protection zone): Prohibition of tilling of permanent pastures and application of terbuthylazine	No constraints requiring compensation	Fixed rate of EUR 165/ha OR Individually set compensation payments based on proof of their economic loss, which range between the fixed rate of EUR 165/ha and the maximum compensation of EUR 200/ha	Fixed rate of EUR 165/ha AND site-specific compensatory payments (EUR 15/ha) OR Individually set compensation payments based on proof of their economic loss, which range between the fixed rate of EUR 165/ha and the maximum compensation of EUR 200/ha
	Since 2001 MEKA measures and compensation are allowed		

Source: Ministeriums für Umwelt und Verkehr (2001) Verordnung des Ministeriums für Umwelt und Verkehr über Schutzbestimmungen und die Gewährung von Ausgleichsleistungen in Wasser- und Quellenschutzgebieten (Schutzgebiets- und Ausgleichs-Verordnung – SchALVO). Schutzgebiets- und Ausgleichsverordnung für Wasserschutzgebiete (SchALVO)(2001). Stuttgart.

Compensation payments are limited to problem and decontamination areas in Zones II and III. If cattle are held, further compensation may be granted for Zone II. Furthermore, site-specific compensatory payments are only made in decontamination zones. The classifications of these areas are evaluated on an annual basis and are re-categorized if the nitrate levels in the groundwater suggest this is necessary (LTZ 2010).

Compensation payments are conditional upon adhering to the constraints set out in the regulation. A breach of adhering to these constraints is deemed as an administrative offence, while the exceedance of nitrate values in soil is not (Müller 1988). This is, no fines are imposed for surpassing nitrate level thresholds. Rejection of compensation payments does not free the farmer from compliance with constraints (LTZ 2008). Further regulatory instruments, such as the Fertilizers and Plant Protection Act, are underlying the restrictions imposed by the SchALVO. However, unresolved legal concepts of the Fertilizer Ordinance impede its potential impact (Kiefer 2005).

MEKA is a voluntary program for farmers outside of water protection areas in which they would receive compensation for implementing measures that improve environmental services. Farmers can freely choose measures that they deem most appropriate for their operation and location (modular system). In MEKA III, 17 of the 27 measures (63 %) were associated with water quality improvements (IFLS 2010). Each measure is allocated a point score per hectare. The compensation payment is then calculated by multiplying the total points by EUR 10. The measures need to be undertaken for a minimum of 5 years for farmers to be entitled for compensation and the maximum compensation payment is capped at EUR 40,000 per company with the exception of cooperatives (Ministerium für Ernährung und Ländlichen Raum 2008).

The water abstraction charge was first introduced in 1988 by amending Baden-Württemberg's Water Act (*Wassergesetz*) and fundamentally revised in its amendment in 2010 (enforcement in 2011). The amendment aimed to optimise the incentives for conservation and protection of water resources and to incentivize investments by water-intensive industries by introducing offsetting options, simplifying the tariff structure, and offering legal certainty (Landtag von Baden-Württemberg 2010a: 1).

In 1988, the size of the water abstraction charge was based on the origin of the water (surface or groundwater), the amount of water abstracted, and its proposed use (Landkreis Karlsruhe 2010). From 2011 onwards, there were only three cost categories, i.e., surface water, groundwater, and water used by public water supply, and this has facilitated administrative procedures (Table 5.3).

Before the amendment in 2010, exemptions included abstractions below 2,000 m^3/year, abstractors that were exempt from requiring water abstraction permits according to the Federal Water Act or the Water Act of Baden-Württemberg (Kraemer and Jäger 1997: 65), and abstractions below the minimum threshold of EUR 100. Charges for abstractions between 2,000 and 3,000 m^3/year were reduced by 50 %. Water-intensive industries could apply for reductions of a maximum of 90 % if they could prove that the abstraction charge impinged on their competitive position, i.e., profits before taxes were reduced by 5 % due to the water abstraction charge (Bundesverfassungsgericht 2007). Reductions of the charge were made

Table 5.3 Water abstraction charges, 1988, 1998, and 2011 (EUR/m³)

	Cost categories	Original charges (1988, EUR/m³)	Revised charges (1998, EUR/m³) (1)	Revised charges (2011, EUR/m³)
Surface water	Public water supply	0.0256	0.0511	0.051
	Cooling	0.0051	0.0102	0.010
	Irrigation	0.0026	0.0051	/
	Other (incl. production, fisheries)	0.0103	0.0205	0.010
Ground water	Public water supply	0.0256	0.0511	0.051
	Heat production	0.0026	0.0051	0.051
	Other (incl. cooling, irrigation, production, fisheries)	0.0256	0.0511	0.051

Sources: Rott and Meyer 1998; Haug 2007; Landtag von Baden-Württemberg, 2010a
Euro conversion rates from 1998 were applied (EUR1 = 1.95583 DM); (1) the original charges are derived by halving the revised charges, based on the statement by Haug (2007: 45) that charges had doubled in 1998

conditional on water-saving efforts and on substitution of groundwater with surface water where possible.

The amendment of 2010 (*Entgelt für Wasserentnahmen 2010*) led to further exemptions, namely, water for cooling of buildings or irrigation purposes, water used for damage aversion or soil, and groundwater remediation, as well as any water abstractions below 4,000 m³/year. To increase investment incentives, a maximum of 75 % of abstraction charges for surface water could be offset by investment costs for measures which reduce heat pollution, improve the ecology of water bodies, or enable the substitution of groundwater with surface water (§17f). Groundwater charges can be reduced by at most 25 % in specific industries if environmental management systems (EMAS or ISO 14001) are used (§17 g). Further reductions are only possible in the case of particular and atypical burdens (§17h) – these do not include competitive disadvantages caused merely by the abstraction charge (MU 2011).

The *Land* Baden-Württemberg as well as the water suppliers (*Grundwasserdatenbank-Wasserversorgung*) closely monitor the water quality in Baden-Württemberg and use this data to control and assess the measures taken to improve groundwater quality (i.e., SchALVO and MEKA). Alternatively, compliance with the constraints from the SchALVO is monitored on the ground by Rural District Offices who measure nitrate levels (Nmin) from soil samples in autumn. In 2004, soil samples were taken from 40 % of the decontamination areas, 25 % of the problematic areas and 3 % of the low risk areas (Finck and Übelhör 2010). In addition, 5 % of the farms and 20 % of the problematic and decontamination areas are controlled for compliance with restrictions on standard agricultural practices (Fink and Übelhör 2010). Compliance with MEKA measures and eligibility for compensation are monitored by the competent licensing office through site visits.

For the tasks relevant to the water abstraction charge, i.e., the approval process for water abstraction and the official monitoring, the water authorities are responsible. In Baden-Württemberg there are three levels of water authorities: the Ministry of Environment (Supreme Water Authority), Regional Councils (Higher Water Authorities),[3] and the lower administrative authorities, such as the city and county (Lower Water Authorities).[4] Water abstractors are required to hand in their declaration of water abstracted on an annual basis. If this is not done, the charge will be based on estimates from the water authorities (§17b, WEEG 1987).

5.2 Setting the Scene: Challenges and Opportunities

With a GDP per capita of EUR 33,655 in 2008 (StaLaBW 2011), Baden-Württemberg is one of the wealthiest *Länder* in Germany. Its 10,749,000 inhabitants also make Baden-Württemberg one of the more populous *Länder* (StaLaBW 2011). The population density amounts to 301 inhabitants/km^2 (SÄBL 2011). Agriculture was the main land user in Baden-Württemberg in 1988 (49.1 %) and 2010 (45.7 %), experiencing only a 7 % decrease over 22 years. Water protection areas increased significantly over time. In 1985, around 379,000 ha (10 % of the total area) were designated for water protection, while in 2010 they increased to around One million hectares (25 % of total area). Around 360,000 ha within the present water protection zones are dedicated to agricultural practices (Finck and Übelhör 2010).

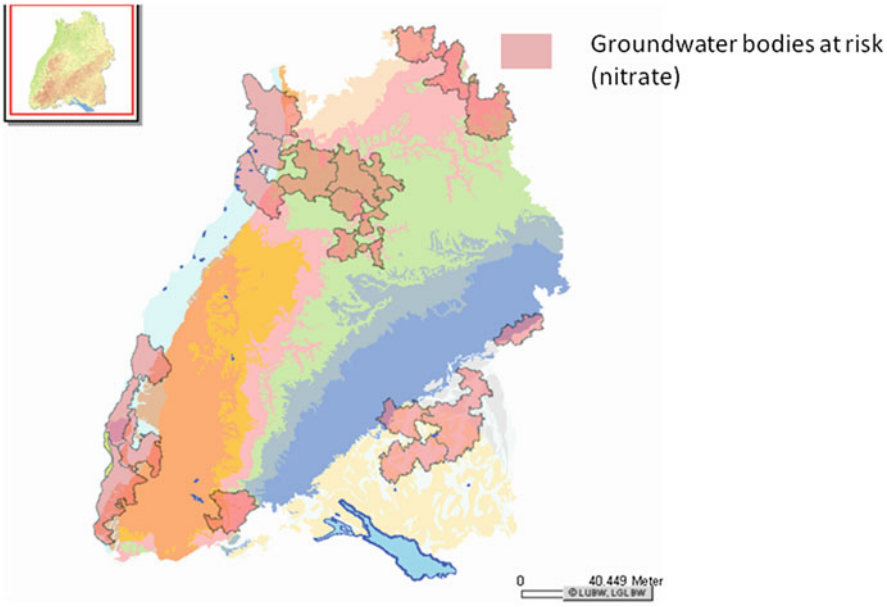
The main pressures on groundwater arise from diffuse pollution (i.e., nitrate). These can be found in regions dominated by agriculture and are often associated with intensive farming practices. Especially the arable loess soils in the plains of the upper Rhine valley and the Kraichgau are affected (see Map 5.1). Furthermore, groundwater bodies located in the moraine areas of Upper Swabia are also at risk. At the same time, the groundwater reservoirs of the Black Forest and the Swabian Alb show only little contamination (RBMPs). As such, a total of 28 groundwater bodies which make up 19 % of Baden-Württemberg's area are categorized as "under risk" because they show concentrations above 50 mg N/l (see Map 5.1).

According to the River Basin Management Plans (RBMPs) of basins within Baden-Württemberg, the main pressures on surface water include flow regulation and morphological changes, such as a lack of consistent flow, changes in structure of water bodies, backwater in rivers, and water diversions for hydropower and industrial processes. Furthermore, in 50 % of the river basins (Alpenrhein, Oberrhein, and Donau) water abstractions lead to *local* groundwater level reductions (Umweltministerium Baden-Württemberg 2009).

In relation with water use, overall water abstraction increased significantly between 1975 and 1987 by 79 % (LUBW 2010). Afterwards, abstraction levels decreased by 34 % between 1987 and 2007. It is apparent that the energy sector is

[3] Regierungspräsidien

[4] Untere Verwaltungsbehörden (Stadt- und Landkreise)



Map 5.1 Groundwater bodies in Baden-Württemberg at risk (>50 mg N/l) (Source: LUBW (2010)

far and away the largest water abstractor in Baden-Württemberg (64 % in 1975, 81 % in 1987, and 77.7 % in 2007) and drove these significant fluctuations in water abstraction. The share of surface water abstracted by the energy sector is constantly 99 % (StaLaBW 2010). With the exception of evaporative and distribution losses, 97 % of the abstracted surface water is returned after its use, mostly to surface water bodies. Aquatic ecosystems are harmed as a result of the higher temperatures of the returned water (thermal pollution) and as a result of residues from coolants (e.g., glycol) (Haug 2007). Water abstraction from agriculture (3.6 mil m^3 in 2007) and services (25.3 mil m^3 in 2007) are comparatively minor.

5.3 The Policy Mix in Action

The introduction of SchALVO in 1988 made compliance with restrictions to the standard agricultural practices, and thus a change in behaviour, compulsory. As nitrate measurements from compliance monitoring of the soil between 1990 and 2008 demonstrate, farmers changed practices in water protected areas, particularly in the early 1990s (Finck and Übelhöhr 2010). Following the amendment, measurements were focused on decontamination and problem areas, and thus are only comparable to a limited extent. Despite the compulsory nature of the SchALVO, 26 % of samples in problem areas (2,678 sites) and 23 % of samples in decontamination

areas (952 sites) exceeded the nitrate threshold value in 2010, indicating that not all farmers altered their behaviour. The focus on problem and decontamination areas led to only 38 % of the water protection area being covered by stricter SchALVO restrictions and monitoring. With only 3 % of the low risk area being monitored for compliance with the general restrictions to standard agricultural practices valid in water protection areas (Finck and Übelhör 2010), it was feared that farmers would return to their prior, unrestricted farming practices which do not protect groundwater resources (Kiefer 2005).

However, as the extremely arid year 2003 illustrates, changes in farmer behaviour and weather-related changes in nitrate levels in soils are difficult to distinguish; thus, the impact of the SchALVO cannot be determined with certainty. Contrary to the SchALVO, the MEKA program is voluntary. Changes in behaviour by farmers can be approximated by the take-up of the program measures. The total area in which MEKA measures were introduced grew from MEKA I (815,000 ha, 50 % of agricultural area) to MEKA II and III (900,000 ha, 55 % of agricultural area). For MEKA III 96 % of the targeted area has been achieved between 2007 and 2009. This illustrates a wide acceptance, as MEKA III only ends in 2013. This trend indicates increasing acceptance and willingness to alter farming practices. The main areas in which MEKA measures are being implemented coincide with areas of high nitrate concentrations in groundwater.

In relation with the impact of the abstraction charge, production processes in the energy sector have changed over time, reducing the amount of water required to produce 1 kilowatt-hour (kWh) of energy by 39 %. Water used in the energy sector has fallen as average from 96.7 l/kWh in 1991 to 59.3 l/ kWh in 2007 (StaLaBW 2010). In addition, water productivity (i.e. the value added per m^3 of water used), has increased by 61.3 % in Baden-Württemberg between 1991 and 2007 (StaLaBW 2010).

However, opinions diverge regarding whether these changes in behaviour were caused exclusively by the abstraction charge. For example, a recent study by Fälsch (2011) showed that there has been a substitution effect from industrial self-providers in reaction to the water abstraction charge. The government of Baden-Württemberg also states that the abstraction charge had a clear impact by changing the incentive functions of economic agents (Landtag von Baden-Württemberg 2010b: 6,888). However, other factors, such as higher water and wastewater prices, technological innovation, and the introduction of the fish habitat regulation (VwV-FischgewässerVO 2001), which sets thresholds to the temperature of returned water in Baden-Württemberg, may also have influenced behaviour (Gawel et al. 2011).

5.3.1 Environmental Outcomes

Between 1994 and 2010, there was an overall decrease of 19.5 % (–5.7 mg/l) in nitrate concentrations in groundwater outside of water protected areas, compared to an overall decrease of 15.9 % (–4.3 mg/l) in water protected areas (Fig. 5.1).

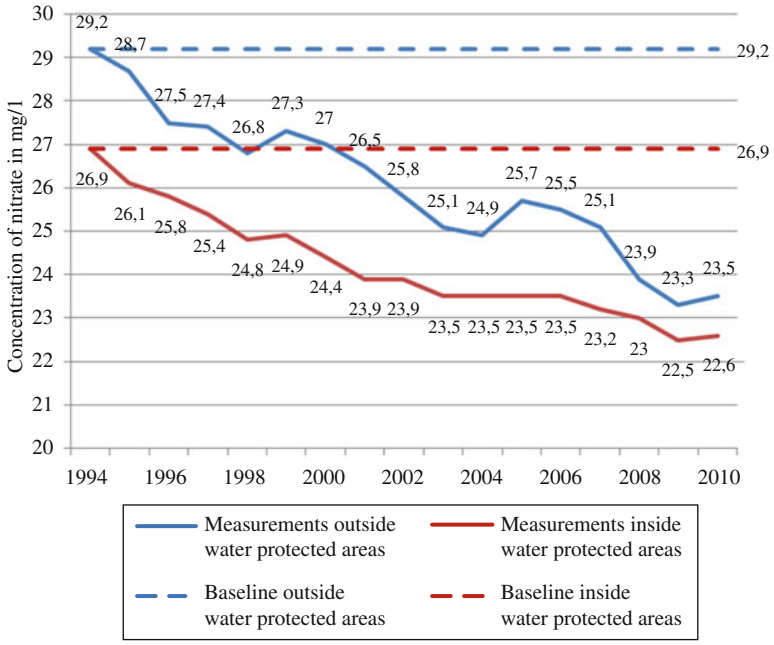


Fig. 5.1 Development of nitrate levels between 1994 and 2010 in and outside of water protected areas and baselines (Source: LUBW 2010: 42); Authors' estimate

When contrasting the change in nitrate concentrations to the baselines of each area, the voluntary MEKA program led to an additional 1.4 mg/l decrease of nitrate (LUBW 2010).

Since the amendment of SchALVO in 2001, decontamination areas have experienced the greatest reduction in nitrate concentrations in groundwater. Concentrations have decreased from 52.1 to 46.5 mg N/l (−10.7 %). Nitrate concentrations in problem areas decreased from 34 to 31.8 mg N/l (−6.5 %). In low risk zones, the levels remained constant at 14.5 mg N/l (LUBW 2010). However, the overall reduction of nitrate concentrations in water protected areas only decreased by 1.3 mg N/l between 2001 and 2010, while it had decreased by 3 mg N/l before the amendment between 1994 and 2001. Thus, while the focus on areas with high nitrate concentrations led to a reduction of concentrations below the thresholds (50 mg N/l), overall the reduction of nitrate concentrations in water protected areas slowed down. This could be explained by the fact that only 38 % of the water protection area was targeted after the amendment and by the low levels of monitoring in low risk areas.

These differing outcomes illustrate that the differentiated restrictions in each area did have an impact on nitrate concentrations. Comparing the reduced pressure from the SchALVO areas with that of the MEKA areas, however, shows that only an additional 13.6 % of reduced nitrate concentrations can be attributed to SchALVO restrictions. It should be noted that other factors, such as differing hydrogeology

and thus differing resident time in soils, were not taken into consideration in this analysis.

As a result of reduced pressure from nitrate from agricultural practices, between 2001 and 2010 the percentage of decontaminated and problem areas decreased by 44.3 % and 13.4 % respectively (LTZ 2010).

Total water abstraction has decreased from 7,619 million m^3 in 1987 to 5,015 million m^3 in 2007 (−34 %). As the energy sector was the main driving force behind the increased water abstraction between 1975 and 2007, the behavioural changes described above led to a 37 % reduction in water abstraction between 1987 and 2007. Decreased water abstraction is likely to have a positive impact on pressures outlined in the RBMPs, namely flow regulation and morphological changes, including water diversions for hydropower and industrial processes.

5.3.2 Economic Assessment

This case study describes a policy mix. To achieve a reduction in nitrate concentrations in groundwater, regulatory (SchALVO restrictions) and economic (compensation payments under SchALVO and MEKA) instruments are combined. No regulatory instrument complements the water abstraction charge to reduce water abstractions. Regarding the SchALVO, the exact impact of the economic instrument cannot be singled out.

With the amendment of the SchALVO in 2001, 50 % of the current compensation payments were eliminated, as only targeted areas (i.e. problem and decontamination areas) received compensation payments, rather than all farmers in water protected areas. These savings of EUR 30 million were used to co-finance the MEKA program. CAP payments (pillar II) from the EU co-financed the MEKA program, doubling the total to EUR 60 million (Mader 2002). Thus, the amendment increased the budget for compensation payments from EUR 60 million to EUR 90 million.

Following legal concerns, the revenues from the water abstraction charge are not earmarked for water protection measures, but flow directly into the federal budget of Baden-Württemberg. However, during the introduction of the water abstraction charge and the SchALVO, it was proposed that the revenue, while not earmarked, would be used to finance the compensation payments (Bergmann and Werry 1989: 2; Müller 1988).

Comparing the revenues from water abstraction charges with the expenditures for the compensation payments between 2002 and 2007, it becomes apparent that, although abstraction charges are not legally earmarked to compensation payments, there is a degree of cost coverage. Further, the amendment of the SchALVO took place in a time when the water abstraction charge revenue did not suffice to cover the compensation payments, as in 2000. This may suggest that these cash flows are linked “informally” despite their legal disconnection (Table 5.4). The amendment of the water abstraction charge is estimated to have led to a reduction of revenues from

Table 5.4 SchALVO and MEKA expenses and water abstraction charge revenues, 2000–2007

	Compensation payments					Revenue
Mio EUR	SchALVO (3)	MEKA (total) (4)	MEKA (water protection) (4)	MEKA (water protection) paid by BW	Total compensation payments paid by BW (5)	Water abstraction charge revenue
2000	60 (1)	107.6	84.7	42.35	102.35	93
2001	n/a	128.1	103.1	51.55	n/a	79
2002	22	147.2	117.1	58.55	80.55	98
2003	21.3	147.8	118.7	59.35	80.65	88
2004	21.7	146.7	117.9	58.95	80.65	88
2005	18.7	136	104.5	52.25	70.95	81.1
2006	18.3	112.2	95.8	47.9	66.2	86.5 (6)
2007	18.6	95.2	83.2	41.6	60.2	82

Sources: (1) Müller (1988); (2) Mader (2002); (3) Landtag BW (2008); (4) Personal correspondence with MLR.; (6) Fälsch (2011)

Note: (5) EU payments contribute around 50 % of the MEKA payments; the exact payment for each year should be seen as an estimate. MEKA payments, as part of CAP payments are planned over fixed periods of time (e.g. MEKA II over 1999–2007) so that the height of compensation payments are fixed to a predetermined maximum over this time

water-intensive industries, such as the energy sector, of around EUR 10–11 million (Landtag von Baden-Württemberg 2010a: 3).

A study by IFLS (2010) found that without the agro-environmental MEKA program, farmers would have intensified agricultural production in many instances and, due to economic incentives, would have only adhered to the minimum regulations regarding environmental protection. Compensation payments under MEKA are generally considered to partially and in some cases sufficiently compensate for additional burdens and reduced harvests. However, certain practices, such as the production of biomass and afforestation, are more lucrative to farmers than the agro-environmental compensation schemes. For the compensation schemes to provide a real alternative to these potentially environmentally harmful measures, they need to be expanded and adapted.

Water suppliers, such as the Landeswasserversorgung, feared that the amendment of the SchALVO would reverse incentives for farmers in low-risk and problem areas and lead to increased nitrate pollution in order to receive (higher) compensation payments (Haakh 2001). However, the Nature Protection Association (NABU) rejects this fear, as farmers can barely cover the additional costs and administrative burdens caused by the strict constraints in problem and decontamination areas (Nabu 2011b). The decrease in problem and decontamination areas supports this argument. Further, Haakh (2001) stresses that farmers outside of the problem and decontamination areas only need to follow the general restrictions for water protected areas – restrictions he fears are neither well defined, nor well monitored for compliance. With only 3 % aerial coverage of monitoring (Fink and Übelhör 2010), this may indeed set the wrong incentives. NABU praises the incentives provided by

the agro-environmental programs, but criticises the low compensation payments, which in the future are expected to be reduced further due to budgetary constraints (NABU 2011a).

The amendment of the water abstraction charge introduced the option to offset investments which improve water ecology, thus extending the incentive function to ecological measures, rather than to just water savings. The increase in investments related to water protection before the introduction of the water abstraction charge in 1988 and before the enforcement of its amendment by the energy sector (StaLaBW 2011), suggests a correlation and shows an announcement effect, as occurred with the introduction of the effluent tax in Germany in 1976 (Barde and Smith 1997). By analysing the level of the water abstraction charges between 1988 and 2010 for water suppliers, Gawel et al. (2011) found that while the nominal rate remained constant, the real rate decreased by around 35 %. The charge has not been adjusted to inflation – thus the incentive effect is reduced.

Since the amendment, charges for the abstraction of groundwater can be reduced (§17g) by implementing environmental management systems (EMAS or ISO 14001). This also might have a positive effect on risk reduction in the future. Whether a shift from external control to internal environmental management systems empirically increases the awareness of the water abstractors or not remains to be seen.

The split of water abstraction charges paid by industrial sector is mostly shared between the energy sector (40.2 % of total charges paid in 2007) and the public water supply (31.1 %; Landtag von Baden-Württemberg 2010a).

While the public water supply could arguably benefit from decreased nitrate levels in untreated water, as treatment costs would be reduced, clear cost savings have not materialized yet due to the limited change in nitrate concentrations. For the Landeswasserversorgung (LW), one of Baden-Württemberg's main water suppliers, the water abstraction charge comprises 8 % of its operating costs. As tariffs are set to recover all financial costs, the expense is taken on by consumers, with water costs increasing by 8 %.

The regional association for industries in Baden-Württemberg (LVI) states that the water abstraction charges lead to a disproportionate competitive disadvantage, particularly for water-intensive industries, as the surrounding *Länder* do not have this type of charge or, as in the case of Hesse, ceased charging it (LVI 2005). As a result, no new water-intensive industrial plants have been constructed in Baden-Württemberg for a long time – a water-intensive industrial corrugated paper plant, with an investment volume of EUR 500 million, was constructed on the other side of the Rhine in the Rhineland-Palatinate *Land,* which does not charge the abstraction charge (LVI 2005).

The nuclear power plant in Philipsburg (part of EnBW Kraftwerke AG) stated that the liberalisation of the energy market in 1998 increased the competitive disadvantage caused by the water abstraction charge, as costs could no longer be transferred to consumers. Following a law suit demonstrating that the water abstraction charged reduced its profits by more than 5 %, Baden-Württemberg refunded part of the past payments. However, EnBW, which is located in Baden-Württemberg and

Germany's third largest energy supply company, states that the average water abstraction charge still contributes to around 1–2 % of operating expenditures. The amendment of the water abstraction charge was believed to reduce this competitive disadvantage, through the option to offset investment costs. Contrary to LVI's opinion that the water abstraction charge could impede new water-intensive investments, EnBW recently constructed a coal-fired power plant (RDK 8) in Baden-Württemberg (EnBW 2011).

The Ministry of Environment, Climate, and Energy (MECE) in Baden-Württemberg agrees that the "energy location" offers more benefits – such as a central location in the heart of Europe and a high concentration of firms and accredited universities both demanding and supplying services – than the water abstraction charge could outweigh (MU 2011). In addition, sourcing outside of Baden-Württemberg is discouraged by lengthy and extensive administrative procedures necessary to abstract and transport water from neighbouring *Länder* which have not introduced abstraction charges (LW 2011).

The amendment of the water abstraction charge reduces the impact on water-intensive industries while increasing their investment incentives. The public water sector is not expected to be affected, although there may be marginal reductions in charges due to a rounding down of the tariff rate and reduction of the minimum claims limit. At the same time, this amendment will not impact residents directly or indirectly. It is expected that, if the discount options are fully realized, the public budget will decrease by an estimated EUR 10–11 million.

While the agricultural sector only paid a marginal amount of the revenue from the water abstraction charge and was exempted in the amendment, it does benefit from the compensation payments for improved agricultural practices (SchALVO and MEKA). This is perceived, particularly by the water supply industry, as the reversal of the "polluter pays" principle (Müller 1988). While legally the revenues from the water abstraction charge are not earmarked for compensatory payments in agriculture, this perception still remains among other stakeholders.

The compensation payments to farmers, however, are at times perceived to not cover the additional costs (administrative, operational and capital costs) which arise due to production constraints. Further, the annual re-assessment of problem and decontamination areas within the SchALVO, reduce planning security for the farmers and may lead to financial disadvantages (Nabu 2011a).

5.4 The Setting-Up of the Instruments and Consideration of Alternatives

Two legislative changes initiated public discussions on SchALVO and the water abstraction charge. For one, the thresholds of acceptable nitrate concentrations, as stated in the Drinking Water Regulation, were tightened from 90 to 50 mg N/l in 1986. In addition, compensation payments to farmers which were restricted in their

agricultural practices by constraints, for example in water protected areas, were made compulsory with the amendment of the Federal Water Law in 1986 (§19(4)).

The *Länder* could decide whether they wanted to implement §19(4) via a centralized model, i.e. the *Land* is responsible for compensation payments to farmers, or via a decentralized model, i.e. the compensation has to occur between the water suppliers and the farmers (Müller 1988).

Given that around 1,000 water companies in Baden-Württemberg were responsible for water supplies and that agricultural activities took place in the around 2,400 water protected areas, the decentralised model did not seem like a viable option. In addition, Baden-Württemberg's history and geography led to very small average farm sizes (in 1987 13.1 ha), which would have increased transaction costs for negotiating compensation (StaLaBw 2008). As strict, area-wide constraints would have been difficult (or impossible) to achieve with the decentralized model, it was decided to introduce the SchALVO in 1988 (Müller 1988).

An array of options was considered to finance the compensation schemes. Following an expert testimony on legal eligibility ("Salzwedel Gutachten"), water abstraction charges crystallized as most promising. This fell in line with the concerns raised in the late 1970s and early 1980s that the current water protection legislation and the *Länder* administrations as a whole were ineffective and not able to fulfil their functions. The choice for water abstraction charges as an economic instrument was in line with the "general movement towards economic and away from regulatory instruments in environmental policy in that time" (Kraemer et al. 1998: 6–7).

The introduction of the water abstraction charge in 1988 was very controversial (Anon 2002). It followed at the *Länder* level after earlier discussions at the federal level in the 1950s and 1960s had failed to impose a federal charge. However, as the Federal Water Act did not provide for abstraction charges, the *Länder* were neither obligated to introduce these charges, nor were they limited in their design if they decided to introduce these (Ginzky et al. 2005).

Initially, the government of Baden-Württemberg intended to earmark the revenues of the water abstraction charges for the compensation payments – the Salzwedel testimony, however, raised serious legal concerns to the legitimacy of this earmarking. Following this, the government of Baden-Württemberg reconsidered the focus of the policy objective of this EPI and diminished its importance as a financing tool for compensation payments (Bergmann and Werry 1989: 2–4). Nevertheless, Müller (1988) states that it is unlikely that Baden-Württemberg would have committed to centralized compensation payments if it had not had the revenues from the water abstraction charge to pay for them.

Baden-Württemberg, in cooperation with relevant water stakeholders, initiated a program to monitor groundwater quality in 1984. Water supply companies supported this undertaking from the beginning by introducing and operating data collection stations and delivering the data to the database for free. In 1992, the water supply companies developed their own groundwater quality database (GWD-WV) in order to increase transparency on water quality levels and monitor and assess the

impact of the measures taken to improve groundwater quality (i.e., SchALVO and MEKA) (GWD-WV 2009). These developments facilitated the enforcement of the agro-environmental programs.

The amendment of the EU Nitrates Directive in 1996 tightened the requirements for the "standard agricultural practice" and thus paved the way for the SchALVO amendment in 2001. As the restrictions for farmers were tightened, the focus of measures could be directed to vulnerable zones, without, at least in theory, the deterioration of non-vulnerable zones.

5.4.1 Issues of Implementability

The public was involved in the legislative process of both the introduction of the water abstraction charge in 1987, and its amendment in 2010.

Before the introduction of the SchALVO, water supply companies, such as the Landeswasserversorgung (LW), warned the government about the seriousness of the nitrate problem (LW 2011). However, the entire water supply industry was strictly against the introduction of water abstraction charges to pay for compensation payments for farmers – these were seen as new subsidies for agriculture and a reversal of the polluter pays principle. They suggested strengthening legislation regulating polluters and enforcing it more vehemently (LW 1986). The agricultural sector, on the other hand, supported the idea of compensation payments, as they felt crushed by regulations and restrictions in water protection zones and suffered economic losses as compensation payments did not occur regularly (LW 1986).

Once the water abstraction charge was in force, industries filed constitutional complaints against the lawfulness of water abstraction charges in 1995 (Rott and Meyer 1998). The legislative competence of the *Länder* to introduce water abstraction charges was substantiated by a decision of the Federal Constitutional Court (2 BvR 413/88 and 1300/93). Following this decision, the acceptance of water abstraction charges gradually improved (MU 2011). Nevertheless, several law suits were filed based on differing reductions to the water abstraction charge. As administrations were free to grant reductions up to 90 %, a great heterogeneity in practices developed, which caused discontent throughout the industry.

Several stakeholder groups, among which were the energy industry, manufacturing industry, agriculture, water supply sector, and environmental and user associations, seized the opportunity of public hearings to get involved in the legal process accompanying the amendment to the water abstraction charge in 2010. While the stakeholders belonging to the industry proposed the cancelation of the water abstraction charges, or at least a drastic reduction in the tariffs, the environmental groups lobbied for a drastic increase. Representatives from agriculture approved of the amendment as irrigation practices were made exempt in the amendment due to the small amount of water used. While the majority of the comments by the industry were denied entry into the legal text, the paper, textile, chemical, and energy industries lobbied for and were granted changes regarding the option to

offset the water abstraction charge with investments (Landtag von Baden-Württemberg 2010a). In addition, the fee structure and the basis for reductions were changed to establish legal certainty, which had been lacking in the previous version. Both amendments are expected to result in discounts to the industry of around 10–11 Mio EUR annually (of a total revenue of ~80 Mio EUR annually) (LVI 2010). The water supply sector, however, continues to disapprove of the water abstraction charge, on the grounds that water prices reflecting financial full cost recovery suffice as incentives for water users to efficiently use the resource (BDEW 2011). Water companies, however, which abstract most of their water from water bodies which are not endangered by diffuse pollution from agriculture such as the Bodensee water supply company, continue to oppose to the water abstraction charges (BWV 2011).

5.5 Conclusions

The presented policy mix can be seen as a rather flexible tool which is capable of adapting to ex-ante and ex-post situations especially related with the overall performance of the combined instruments to achieve identified goals. The SchALVO was amended in 2001 as a reaction to limited success in reducing nitrate concentrations through voluntary action. The MEKA measures were adapted over time to match the compensation with the burden or losses the measures implied. Furthermore, the (modular) design of the MEKA measures maximizes the flexibility for farmers. Likewise, the water abstraction charge was amended in 2010 to increase the incentives for innovation and sustainable practices and increase legal certainty in administrative procedures.

Fundamentally, and due to the fact that the instruments are interlinked as part of a whole policy mix, it has been a challenge to disaggregate the effects and impacts of the different policy instruments in isolation. Overall, it can be concluded that the MEKA and SchALVO measures have been considerably successful in reducing groundwater nitrate concentrations in Baden-Württemberg. However, it can be assumed that the success would have been higher if monitoring activities had been expanded and enforcement measures, such as fines for non-compliance, had been imposed. On the other hand, strict enforcement is difficult when monitoring the impact of agricultural practices is done by measuring the nitrate levels in soil, since concentrations are aggravated by the impact of climatic conditions.

While the water abstraction charge internalises the *environmental and resource costs*, the compensation payments for farmers arguably contradict the *polluter pays principle*, both concepts which are set out in Article 9 of the WFD. Legal certainty and clarity regarding reduction schedules for the water abstraction charge appeared to be crucial for increasing acceptability among industries (e.g. energy, chemical and paper) and decreasing transaction costs, particularly legal costs, for all stakeholders. Furthermore, the option to offset investment costs for ecologically-friendly measures against the abstraction charge further increased acceptance among

the industry and was perceived as compensation for any competitive disadvantage the charge might have caused. The perception that revenues are being used to finance measures which improve water quality (i.e. MEKA and SchALVO) increased the acceptability of water supply companies which depend on water sources endangered by agriculture. Finally, experience with these measures in Baden-Württemberg has shown that transaction costs can be reduced by introducing joint applications for compensatory measures (e.g., for MEKA and SchALVO) and by harmonizing administrative procedures to already existing economic or regulatory instruments (e.g., the water abstraction charge was linked to existing procedures of the effluent tax).

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