

24th. That the water-rights of the streams now taken up for mining-purposes in the mountains do not conflict with the irrigation of the plains, the water being returned to the natural channels above the points where it will be taken out for irrigation, at least for many years to come.

Respectfully submitted.

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SAN FRANCISCO, CAL.,
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APPENDIX 1.

A large portion of the water in the Cavour Canal is sold to a species of co-operative society at Vercelli, known as the "General Association of Irrigation west of Sesia."

This society was founded by government under an act of 3d of July, 1853, and owes it[s] origin to Count Cavour. It had for its object, at starting, to lease, administer, and employ in general, according to an economical and matured system of irrigated cultivation, the waters of the Crown Canals derived from the Dora Baltea, in terms of the grant made with the state finance for the irrigation of the respective properties of the shareholders, with the power of extending successively the benefits of the association, even to the mutual assurance against losses by hail, fire, and such like, and to other social objects of mutual profit.

By the terms of the agreement made between the society and government, the society were thereby granted a thirty years' lease of all the waters of the Crown Canals of the Dora Baltea, with certain exceptions in favor of the owners of old hereditary rights, entitling them to a free use of a portion of their waters.

The volume thus reserved amounts to no less than 793 cubic feet per second.

When the Cavour Canal Company was formed it was obliged to abide by this agreement with the irrigation society, and in 1867 there was supplied to the latter from the waters of the Po 900 cubic feet, and from those of the Dora Baltea Canals, after the deduction above alluded to, 537 cubic feet per second, while this year (1868) they have sent in an application

for 971 cubic feet of the former and for 659 cubic feet per second of the latter waters.

The regulations and statutes of this Irrigation Society are too long to give in detail, for they consist of 379 articles, in 76 pages octavo; but the system possesses sufficient interest to be described minutely.

In each *commune* or parish irrigated by these canals, there is a society termed a *consorzio agrario*, composed of all the proprietors within the parish who take water for their lands; or, in certain cases, a *consorzio* may be composed of proprietors of adjoining small parishes. Each *consorzio* elects by universal suffrage one or two deputies, according as it uses a discharge of less or more than 30 module (61.4 cubic feet per second) on its irrigation. These deputies form an assembly for the general administration of affairs. They must be themselves members of the society, over twenty-five years of age, "sufficiently acquainted with agriculture," and men of good character. They receive no salary as deputies, nor are they allowed to hold any paid office under the society. They are elected for three years, and may be re-elected. They meet regularly twice a year, on the 15th of March and the 15th of November, and half their number form a quorum. They elect from among themselves a president and vice-president, whose functions last for three years, and each year they choose also an honorary secretary and two assistants. They pass the accounts of the year, settle how much is to be paid by each *consorzio*, what salaries their employes are to have, listen to suggestions for the benefit of the society, and, in short, generally direct and control the whole of its business. The rules passed by the assembly are binding on all the members of the society. To help them in forming decisions, they have a legal and an engineering adviser.

From among themselves the assembly elect three committees: the direction-general, the committee of surveillance, and the council of arbitration.

The first is the committee of management of the affairs of the society. It consists of a director-general, three members, a secretary, and an assistant secretary. If the director-general likes, he may appoint a colleague, with the approval of the assembly, to take his place in case of illness or absence.

The director-general may call on the assembly to dismiss any of the members of his committee, or he himself may suspend them for not doing their duty. He has in every way to watch over the interests of the society, to see to the conduct of its servants, and to give them rules for their guidance, to direct any works, to disburse expenses, to arrange with the government (or with the canal company) for the amount of water required at each point, to see generally to the distribution of the water over the irrigated district, to carry on all communications with the government--in short, to be general manager. The director-general receives an allowance of \$1,800 a year, from which he is expected to pay a number of small charges, and each member of his committee receives a certain salary. This committee has its headquarters at Vercelli, and renders an account of its proceedings at each meeting of the general assembly.

The committee of surveillance is "the eye of the assembly over the direction-general," and has to see that it carries out faithfully its

duties toward the society. It consists of three members, of whom the oldest presides. They meet once a week, and each time receive a ticket which entitles them to a small allowance, as fixed at each general assembly; in 1866 the whole amount being only \$152. Should they think necessary, they may call an extraordinary meeting of the assembly, and at each ordinary meeting they make a report of their proceedings.

The council of arbitration has for its object, "1st, to settle all disputes regarding affairs of the society which may arise between the members and the society, or between the society and its servants; 2d, to decide cases of breaches of the rules and discipline of the society; 3d, to assist the society in actions before the courts; 4th, to give their advice on whatever may be referred to them by the director-general; 5th, to fix and settle, in case of dispute, the compensation for the passage-outlet, or any other obligation or damage occasioned by the flowing distribution, employment, recovery in drains, and escape of the waters of the society, whether affecting the interests of the society with its members or among the *consorzios* or members with each other."

This council is composed of three members of the assembly, who must be resident in Vercelli, and are elected annually. They receive no regular pay, but get certificates of attendance at meetings like the committee of surveillance, and these certificates entitle them to a small remuneration, of which the whole amount in 1866 was \$223. Their decisions are settled by the opinion of the majority. There is always the power of appeal from them to the ordinary courts of justice; and, to admit of this appeal, the execution of their sentences is deferred for fifteen days after being promulgated, unless in cases where, for the sake of the crops, it must be carried out at once. After fifteen days, if no appeal has been made, the decisions of the council are looked on as final. When necessary, the council summons a lawyer or engineer to their assistance. All charges of this council are paid by whoever loses the case. The director-general is not allowed to carry on any lawsuit on the part of the society without the previous sanction of the council of arbitration.

The money transactions of the society are under a cashier, who has to give a security for \$4,000, and who is responsible for all connected with their cash. His chest has three keys, of which he keeps one, the director-general another, and the third is held by the largest shareholder of the society, who is a member of the general assembly, and happens to live in Vercelli. Money is issued on the checks of the director-general, and once a month he and the member who keeps the third key of the cash-box count the cash and audit the cashier's books.

To effect the distribution of the water, the area irrigated is divided into a certain number of districts, (at first only four, but increased since.) in each of which there is an overseer in charge of the irrigation, termed the *delegato*, who receives his orders from the direction-general, and several guards or water-bailiffs, termed *acquainolo*. These officers patrol the water-courses, see that the modules are discharging their proper amount, that the water that passes off the fields is not running to waste, but is caught in catch-water drains, from which at a lower level it can be again utilized, (a point attended to with admirable care in the Piedmontese irrigation,) and do all

the other ordinary duties connected with their position. Neglect of duty or disobedience of orders subjects them to fines, reduction of salary, or dismissal.

It may be seen by the agreement between the society and government that, while the latter became responsible for the entire maintenance of the main canals, the irrigation society has to pay for all current repairs, &c., of the minor canals, which repairs the government (or now the Italian Canal Company) executes for them, and that all further operations of distributing water, &c., are entirely carried out by the irrigation society's agents, and at their cost. This society, then, has in its employ no engineers, but a number of irrigators. Their executive operations are divided into those of interest to all, and those affecting merely single *consorzii*. To the former belong the general maintenance of the branch canals, the formation of new ones, the catch-water drains, &c., which are paid for from the funds of the society at large. To the latter belong the maintenance of small water-courses and minor works, which are charged to those *consorzii* alone who are benefited by them.

The cost of executing such works is paid for at the time by the society and recovered from the *consorzii* afterward, who tax each individual according to the extent and species of his irrigated crops, which is supposed to give a fair approximation to the proportionate share of water which he has consumed.

This is a point to be noted. Previously to visiting these canals, I understood that water was universally issued by module, and that the administration of the canal had no monetary interest in the question of whether a cultivator made an economical use or not of the discharge allotted to him. I believe this is nearly the case in Lombardy, but by no means in Piedmont.

The Piedmontese module of 2.047 cubic feet per second is too large a unit to apply to small properties, and in most cases the cultivator may be said to pay, according to the area he waters, just as much as with us in India.

Article 16 of the statutes of the irrigation society runs as follows: "All payments for irrigation are to be made in money at the rate of so much per hectare." The society, it is true, buys its water from the canal company by module. It distributes it by module among its districts, and the irrigation overseers supply it by module to the various *consorzii*. But there the measure ceases.

In November of each year each *consorzio* makes out an indent of the number of acres of each description of crop that is desired to be irrigated within its limits during the summer of the year following, and each December this ought to be sent in to the director-general; and on these indents are settled how many modules are to be issued to each.

At the end of the season each *consorzio* is called on to pay for a certain discharge of water received by it, as well as for the maintenance, repairs, &c., of the works particularly connected with it, and for its share in the general expenses of the whole society. The *proper* system, then, is to make out a calculation for each irrigator, which is done in

each *consorzio*, allowing at the rate of one cubic foot a second for $43\frac{3}{4}$ acres of rice, one cubic foot a second for 100 acres of meadow, and one cubic foot a second for 304 acres of Indian corn.

Supposing, then, that an irrigator had watered 10 hectares of rice, 20 of meadow and 20 of maize, he would be charged for 60 modules, or 1.23 cubic feet per second; and if the whole consumption of the *consorzio* had been 24 modules, and the whole cost \$6,000, he would have to pay one-fortieth, or \$150, for the irrigation of his 50 hectares, or 123.5 acres. But the next year he might find he would have to pay considerably more or less, according as the working-expenses of the year had increased or diminished.

Should any cultivator have used great economy of water, and irrigated fields which he had not entered in the annual indent, he would be charged for all this irrigation, although by so doing he might help to cheapen the water issued to the *consorzio*; that is, the *consorzio* as a whole would pay for its 24 modules; and if, by any means, some of its members make these 24 go as far as 30 modules that had been calculated for, the effect would be to reduce the rate on every hectare within the *consorzio*. This, however, is not a case that is likely to occur. The certainty of getting a fixed supply and having to pay a fixed rate for it, irrigating year after year precisely the same lands, is preferred to the chances connected with any system by which a man's endeavors to economize water might be rewarded by having to pay less for it. Nor do I believe there is much waste, so carefully is the water collected in drains round the fields and passed off to other distribution-channels.

In North India the case is totally different. There a man's irrigable area, as a rule, far exceeds that for which in any one year he will have sufficient water. Here the whole irrigable area may be watered; and if it is not, it is because in the rotation of crops irrigation is not required for it all, not because there is any lack of water.

While, then, the Italian irrigator is enabled every year to get the fields watered which he wishes, and is contented to pay a fixed moderate sum for it, the more intelligent and industrious of the North Indian peasantry consider the more water they can get the more the area they will irrigate. The system of supplying water by module to them, which has been so highly extolled, and which as yet has never succeeded, would doubtless be an inducement for the more indolent classes to use the precious element with economy; but I think my brother canal-officers who have most experience in the matter will agree with me that among the villages inhabited by the hard-working castes (I instance especially the Jats in the districts of Delhi, Meerut, and Kurnal, with whom I am personally best acquainted) there will be very little saving of water effected by introducing the module system. Its other advantages in restricting the canal establishment to their own works and removing the interference with the villages caused by the yearly measuring parties, with their concomitant amount of rascality and bribery, I think are undeniable.

The system above described has been called the proper system, for it is the one which the society has laid down in its statutes. In the case of the water-rate for rice, however, the old system is still in vogue, to some extent, of paying in kind.

Before the cultivator is allowed to reap his rice-crops he is obliged to give due notice to the *acquainolo*, in order that one of the society's agents may inspect the field. When the rice is cut it must be conveyed to a thrashing-floor provided in each *consorzio* by the society, and there its agent takes as payment for the irrigation one-sixth of the crop, which is thereupon conveyed at the expense of the irrigator to the great central granary which the society possesses at Salasco.

Why this system should be still allowed to exist seems strange. In Col. B. Smith's time he found it unpopular, and the society in their statutes provide for doing away with it and receiving payment in money for rice as for the other crops; but still it goes on, although only to a small extent.

The rice irrigation is generally continuous, any one taking just what he requires, and when he requires it. The other irrigation is conducted by a rotation, or *ruota*, as it is termed, of fifteen days, beginning each year on the first of April.

The *marcite* fields or meadows, arranged in succession of ridges and furrows, receive their waters in summer in the same way as the regular crops by a regular rotation; but in winter the system is quite different. This is the only species of irrigation that goes on at all during these months, and the waters of the *fontanili* (springs) having a higher temperature in winter than that of the canals, is generally preferred for this kind of irrigation, which must go on continuously, or the frost sets in about the grass and checks its growth.

The irrigation society has the lease of all the *fontanili* belonging to the crown and of many others within the limits of its irrigation, and these are put up to auction, for periods not exceeding nine years, to be used for *marcite* irrigation from the middle of September to the middle of March. For the rest of the year these *fontanili* are used for general irrigation, and do not belong to the winter tenants.

For the local management of the *consorzii*, the members in each elect, along with their deputy who represents them at the general assembly, six others, (or, if there be over 200 electors, nine others,) and these, with the deputy as president, form an administrative committee. They have the whole management of the irrigation with their own *consorzio*. They correspond with the direction-general, arrange what works require repair, and in fact are the mouth-piece and representative of their parish.

The society undertakes, when it has enough of water, to supply lands with irrigation which do not properly come within its area, as, for instance, when they only require an occasional watering, and are so situated as not to be able to receive it continuously. These lands are charged at the same rate as those belonging to the society.

The water-power is let to millers, the rates being fixed by the number of stones driven, rather than by the head of water disposable.

Article 244 of the statutes lays down that "every member of the society is obligated to place, without any return of identification, at the full disposal of the society all the trenches, channels of *fontanili*, ditches, and water-courses, with the buildings pertaining to and connected with them, and all the works of all kinds without exception, which exist

on his property, in order that the same may be made use of for the passage, distribution, and employment of fresh waters, as well as for those recovered by the drains, and for the transit of drains."

The proprietor, too, is obliged to keep these channels in working-order at his own expense, or, if he neglects to do it, the direction-general will do it for him, and charge him with the amount. All the water that passes off the irrigated fields into the society's drains becomes again the property of the society, so that the irrigator has only a right to the use of the water while it passes over his lands, and he must not prevent its escape into the drains provided for it.

If any member of the society possesses a *fontanile*, or has a hereditary right to a certain discharge of water beforehand, he may make this over to the society at a valuation, which they will give him for it by way of yearly rental.

The statutes provide a number of fines for breach of canal laws. Any one interfering with the channels or water-courses may be fined from \$4 to \$12. Any one tampering with the canal-buildings or altering the sluices may be fined from \$6 to \$18. There is a fine of \$3 for hindering the water from going into the drains, and one of from \$20 to \$60 for wasting the society's water. Any member caught selling the water is fined double the sum he is believed to have got for it.

Whoever tries to cheat in paying his rice contribution is fined double the amount he tried to escape paying, and whoever conceals fields he has irrigated is charged \$10 for every hectare he has concealed. The amount of fines goes one-half to the funds of the society and the other half to the charitable support of old *acquainoli* who are unfit for work. The half that accrued to the society's fund in 1866 was only; \$68 double of that, \$136, represents the whole fines of the year. They are certainly very low.

There remains to describe not the least important part of the society's administration, namely, the financial. By its agreement with government, the irrigation society was bound to raise and maintain a reserve fund of \$60,000, as a security for its proper management. It was permitted, however, to borrow from this fund capital to carry on its expenses the first year, and in any other year when there should be extraordinary charges to meet. It was further allowed to raise this capital by a loan to be paid off in four installments, so as not to press too heavily the first year on the society. Each irrigator then, from the government canals, was called on to become a member of the society, and to send in a statement of the area and description of crops which he was in the habit of watering and wished to continue to water. The same calculation was then gone through as given, allowing per hectare .028 module for rice, .012 module for meadow irrigation, and .004 module for Indian corn, and, according to the number of modules thus required by any irrigator, he became a shareholder in the society.

Supposing his whole area required .60 module, and that all the original shareholders together require 300 modules, he would be considered as the owner of one five-hundredth of the concern, and would have to pay that fraction of the fund of \$60,000, or \$120. The original shares thus formed are liable, like any others, to rise or sink in value, and may be divided, sold, and bought, &c., along with the lands to the irrigation of which

they refer. Any irrigating proprietor not entering the society when he might have done so, and wishing to do so afterward, is bound to pay for the shares according to their market-value at the time, and, in addition, an entrance subscription equal to half the original value of his shares.

Those, however, joining afterward, on account of the society having brought them irrigation they had not before, (the new irrigators, for instance, on the Cavour Canal,) are not obliged to pay this entrance subscription, but merely to buy their shares at their value at the time.

I have before me the detailed accounts for the year 1866, from which I have made the following abstract:

ASSOCIATION-GENERAL OF IRRIGATION WEST OF THE SESIA.

Abstract of expenditures and receipts for the year 1866.

Expenditure, (neglecting the decimals:)	
Salaries for establishment for the year	\$12,350
Price of water purchased, Italian Canal Company	135,505
Price of water purchased from various private sources	7,200
Maintenance and supervision of secondary channels	8,355
Maintenance and supervision of water-courses, &c., from fountains	7,360
Hire of buildings	315
Compensation for land occupied	400
General expenses of office and direction	5,290
Expenses of society's rice-granary at Salasco	1,125
Allowance to members of committee of surveillance for their sittings	150
Allowance to members of council of arbitration	225
Legal expenses	1,480
Interest at 5 per cent. of the capital of society	5,380
House of refuge for old servants	760
Advances to <i>consorzii</i> for carrying on works	38,775
Sundry ordinary charges	1,355
Construction of various new works	7,325
Various extraordinary charges--purchase of land, &c.	2,940
Balance of receipts paid as bonus to shareholders	<u>11,770</u>
Grand total	248,060
Receipts:	
For 1,559 cubic feet per second of water sold for irrigation	\$152,480
Price agreed on for watering about 4,750 acres of rice in various places	20,955
Value of 1,043 sacks of rice of sorts, paid in kind as water-rent	5,745
For sundry other detached portions of irrigation	8,970
Rent of rice and corn mills, with water-power	7,270

Receipts, cont.:

Advances, for carrying on works, to various <i>consorzii</i> , recovered	38,775
Interest received from capital of the society	8,160
Fines for breach of rules	70
Commission paid to council of arbitration for cases referred to them	195
Rent of houses and lands belonging to the society	465
Various sundry ordinary receipts	965
Sundry ordinary receipts, recovery of advances, &c	2,370
Refunded by Italian Canal Company for work done for them	1,305
Capital of society increased by purchase of shares	<u>335</u>
Grand total	248,060

The chief item of expenditure of course is for the water brought from the Italian Canal Company. Of this, 714.4 cubic feet per second was water brought by the Cavour Canal from the river Po, and bought at \$200 per module, or \$87.39 per cubic foot per second; and 674 cubic feet per second was water of the Dora Baltea, bought at \$160 per module, or \$69.91 per cubic foot per second. These were the prices stipulated in the agreement with the government, the extra value of the Po being due to the fact of its alluvial silt being considered highly fertilizing, while that of the Dora Baltea is rather the reverse. The expenses for repairs, establishment, &c., appears very moderate. Five thousand three hundred and eighty dollars was paid as interest, at 5 per cent., to shareholders, on the capital of the society, which appears to have amounted altogether to \$107,140 at the end of the year. Thirty-eight thousand seven hundred and seventy-five was advanced throughout the year to various *consorzii*, to help them to carry on works, and recovered again, as shown among the receipts, 5 per cent. being charged for it while lent.

On the other side, of course, the principal receipt is for water sold to the different *consorzii*, that of the Po being charged for generally \$220 per module, or \$96.11 per cubic foot per second; and that of the Dora Baltea at \$175.50 per module, or \$76.89 per cubic foot per second, an increase in price of 10 per cent. above what was paid for it; \$5,745 worth appears to have been received as payment for irrigation, and the society must have invested their capital to good advantage, getting \$8,160 of interest for it, or about 7 1/2 per cent.

The result leaves a balance of \$11,770 to be paid as a bonus to the shareholders, altogether a satisfactory conclusion, considering that they have received 5 per cent. on the value of their shares, as well as uninterrupted and well-organized irrigation at a reasonable price throughout the year.

As to the important question of what the area actually watered by this society is, and how far they make a cubic foot of water go, I could gain no exact statistics. On the latter point I was told that at Vercelles they were supposed to get more duty out of water than anywhere else, and that it was as high as 84 acres per cubic foot per second. This is, of course, very

small indeed, compared with our results in India, but the reasons are perfectly satisfactory, showing that we can take no credit to ourselves there for being better irrigators than the Italians.

While in India there are few weeks in the year when the whole amount of water is not being fully used and in high demand, the irrigation season proper in Italy only lasts for the six or seven months beginning with April, and during the remaining months all the water is given to the *marcite* fields, which require an immense quantity, and which probably would not be of nearly so great an extent if it were not that there is plenty of water to give them. Another important difference, both here and in Spain, from our irrigation in India is, that in the former countries rice is grown, and therefore irrigated during the months in the year when the whole rain-fall does not exceed 5 inches in Spain and 22 inches in Piedmont, while in Northern India advantage is always taken of the monsoon for this cultivation, and the irrigation is assisted by heavy rains.

Altogether I believe we may take the whole area watered by the irrigation society at about 138,000 acres. I have thought it worth while to describe at some length the system adopted by it, both because it was originated by one of the ablest statesmen, Count Cavour, a man much interested in agriculture, and so it is likely to be worth describing, and also because it has practically shown by its working for the last fourteen years that irrigation may be successfully administered by an agency perfectly distinct from that which has the control of the canals supplying it.