

SECTION XIV.

WATER CONSERVATION AND IRRIGATION.

§ 1. Artesian Water.

1. **General.**—In every country in which droughts are recurrent, there are few problems the solution of which is of greater importance than that of an adequate system of water conservation. Much has been done in the Commonwealth so far as the supply of water to centres of population is concerned, and a description of several of the metropolitan water works will be found herein, viz., in the section dealing with "Local Government." In May 1912 an interstate conference on artesian water was held in Sydney, at which it was agreed that combined Governmental action should be taken with reference to delimitation of the artesian basin, hydrographic survey, analyses and utilisation of artesian water, etc. (See map on page 497.)

(i.) *The Great Australian Artesian Basin.* In speaking of the "Great Australian Artesian Basin," the area is understood which includes (a) considerably more than one-half of Queensland, taking in practically all that State lying west of the Great Dividing Range, with the exception of an area in the north-west contiguous to the Northern Territory; (b) a considerable strip of New South Wales along its northern boundary and west of the Great Dividing Range; and (c) the north-eastern part of South Australia proper, together with the extreme south-eastern corner of the Northern Territory. This basin (shewn approximately by the map on page 497) is said to be the largest yet discovered, and is about 569,000 square miles, of which 376,000 square miles are in Queensland, 90,000 square miles in South Australia, 83,000 square miles in New South Wales, and 20,000 square miles in the Northern Territory. The area of the intake beds is estimated at 60,010 square miles, viz., 50,000 square miles in Queensland and 10,010 square miles in New South Wales. A description of the basin and its geological formation will be found in previous issues of the Year Book (see No. 6, p. 569).

(ii.) *The Western Australian Basins.* The Western Australian Basins fall naturally within five distinct groups, viz., the Eucla Basin, in the extreme south-east of the State, and extending well into South Australia along the shores of the Great Australian Bight; the Coastal Plain Basin, west of the Darling Range; the North-West Basin, between the Murchison and Ashburton Rivers; the Gulf Basin, between Cambridge Gulf and Queen's Channel; and the Desert Basin, between the De Grey and Fitzroy Rivers. The boring operations in these basins are referred to hereafter (see page 496).

The Recent and Tertiary strata which enter Western Australia at its eastern border, and which have a prevailing dip towards the Great Australian Bight, form the Eucla artesian water area. But where boring operations have been undertaken, the water has been found to be salt or brackish, and there are other conditions affecting the supply, such as local variations in the thickness of the beds, their relative porosity, and the unevenness of the floor upon which they rest, which, so far, have not been examined with sufficient thoroughness to enable many particulars to be given in regard to this basin.

In the Coastal Plain Basin to the west of the Darling Ranges artesian boring has, on the other hand, been carried on successfully for many years.

(iii.) *The Murray River Basin.* In August 1910 a report was issued by the Government Geologist of South Australia on the geology of the country south and east of the Murray River, with special reference to subterranean water supply in wells and bores along the Pinnaroo and Bordertown railways. The tertiary formation in the district under consideration occupies the western portion of a vast basin or depression, of which the greater part extends eastward into Victoria and northward into New South Wales. This basin is bounded on the west by the azoic and palæozoic rocks of the Mount Lofty and other ranges, extending northwards from near the mouth of the Murray to the Barrier Ranges, and on the east and north-east by the ranges of Victoria and New South Wales. This tertiary water-basin is occupied by a succession of sedimentary formations, both porous and impervious. It is of interest to note that the waters of the Murray River are partly supplied by influx from the water-bearing beds of this basin; this is proved by the fact that, at low water, springs are observed at certain places flowing into it from beneath the limestone cliffs from Pyap Bend downwards. Similar springs must exist along the courses of other branches of the River Murray system, where they cut through the tertiary formation.

(iv.) *Plutonic or Meteoric Waters.* In previous Year Books will be found the theory of Professor Gregory¹ as to the origin of the water in the Australian artesian basin, together with the objections held thereto by the Government Geologist of New South Wales.² (See Year Book No. 6, p. 570.)

(v.) *Particulars of Artesian and Sub-artesian Bores, 1913.* The following table gives particulars of artesian and sub-artesian bores in each State and in the Northern Territory up to the end of the year 1913:—

COMMONWEALTH AND STATES.*—PARTICULARS OF ARTESIAN AND SUB-ARTESIAN BORES, 1913.

Particulars.	N.S.W.	Vict.	Q'land.	S. Aust.	W. Aust.	N. Ter.	Total.
Bores existing ... No.	476	153	2,259	125	88	62	3,163
Total depth bored ... feet	794,658	194,665	2,351,133	87,714	102,922	20,889	3,551,981
Daily flow ... ,000 gals.	106,083	†	506,502	...	30,961	2,584,461	...
Depth at which artesian water was struck—							
Maximum ... feet	4,338	675	5,045	4,850	4,016	502	5,045
Minimum ... feet	46	131	10	65	175	110	10
Temperature of flow—							
Maximum ... ° Fahr.	148	†	211	208	140	†	211
Minimum ... ° Fahr.	70	†	81	82	60	†	60

* There are no artesian bores in Tasmania. † Not available.

2. **New South Wales.**—Artesian boring in New South Wales dates from 1879, when a private bore was put down on the Kallara pastoral holding, between Bourke and Wilcannia. The first Government bore was that at Goonery, on the Bourke-Wanaaring road, completed in 1884. At the end of 1913, out of 476 known artesian bores in New South Wales, 196 were Government bores.

1. See J. W. Gregory, F.R.S., D.Sc.: "The Dead Heart of Australia," London, John Murray, 1906; "The Flowing Wells of Central Australia," Geogr. Journ., July and August, 1911.

2. E. F. Pittman, A.R.S.M., *Government Geologist of New South Wales*: "Problems of the Artesian Water Supply of Australia, with special reference to Professor Gregory's Theory." (Clarke Memorial Lecture, delivered before the Royal Society of New South Wales, 31st October, 1907); also "The Great Australian Artesian Basin," Sydney, 1914.

The distribution of these bores was as follows:—

NEW SOUTH WALES ARTESIAN BORES ON 31st DECEMBER, 1913.

Particulars.	State.	Private.	Total.
Bores existing No.	196	280	476*
Total depth bored feet	380,805	413,853	794,658*
Daily flow gallons	60,020,819†	48,062,593	108,083,412
Depth at which water was struck—			
Maximum feet	4,338	3,578	...
Minimum "	89	46	...
Temperature of flow—			
Maximum ° Fahr.	139	148	...
Minimum "	70	73	...

* Exclusive of 21 Government and 23 private bores which failed; the total depth bored being 27,566 feet and 30,227 feet respectively. † Excluding the flow from nineteen pumping bores, the particulars of which are not available.

Of the wells at the end of 1913, the depth is stated in 476 cases, ranging from 46 to 4338 feet. There is a preponderance of wells from 1000 to 2000 feet in depth, but neither the shallow wells under 500 feet, nor the very deep wells over 3000 feet are so numerous in proportion as in Queensland. The two deepest wells in New South Wales are those at Boronga, in the County of Staphylton, with a depth of 4338 feet and a daily outflow of 1,062,133 gallons; and at Dolgelly, in the Parish of Careunga, in County Staphylton, with a depth of 4086 feet, and an outflow of 622,185 gallons per day. The largest outflow is stated to be that at the Boobora bore, in the County of Staphylton, which yields 1,133,300 gallons a day, and has a depth of 3225 feet.

The flow from seventy-one of the State Government bores is utilised for supplying water for stock on holdings served in connection with Bore Water Trusts or Artesian Districts under the Water Act of 1912. The total flow from these bores amounts to 39,869,046 gallons per day, watering an area of 4,331,176 acres by means of 2597 miles of distributing drains. The average rating by the Bore Trusts to repay the capital cost with 4 per cent. interest in twenty-eight years, is 1.515d. per acre, including the cost of maintenance and administration.

In the majority of cases the remaining bores are used by pastoralists for stock watering purposes only, but in a few instances the supply is utilised in connection with country towns.

The watering of the north-western country by means of bore water has largely increased the carrying capacity of the land; but, what is of perhaps the greater importance, it has made comparatively small pastoral settlement practicable in country previously confined almost entirely to the operations of companies holding immense areas.

A general yearly decrease in the flow from the bores is still being recorded, and action is being taken to prove whether this observed decrease is due to loss in supply under pressure, or to local causes, such as lateral leakage.

A novel undertaking has been carried out at Moree, 400 miles north-west of Sydney, where the water of a highly mineralised artesian bore is utilised for the supply of municipal swimming baths.

3. **Victoria.**—Victoria lies altogether outside the Great Australian Artesian Basin, and as water is obtainable in most parts of the State at shallow depths, there has not been much occasion for artesian boring. As early as 1884, however, an artesian well was bored at Sale, which for a number of years gave a supply of about 100,000 gallons per day until, either through corrosion of the casing or by choking up with sand from below, the flow ceased. In 1905 a new bore was therefore put down, which at a depth of 277 feet yielded sufficient water to fill Lake Guthridge, a local depression. But as the water was impure, and contained too much sulphuretted hydrogen, boring operations were continued to 520 feet,

when the lowering of the casing shut off the supply of water. A further bore was then put down at some distance from the first, and this, at a depth of 238 feet, yielded a fresh and clear water supply, which at present is stated to be about 145,000 gallons per day. Further trouble, however, has been experienced owing to failure of casing, and a fresh bore is being put down.

In the late eighties a number of bores were put down in the north-western part of the State, varying from 200 to over 2000 feet in depth, but without any notable success. In 1897 a Board reported on boring for artesian water supply in the Mallee country, but this report was adverse, except as regards the extreme northern portion thereof. In 1906 eight bores were put down on the Overnewton Estate, Maribyrnong, to depths varying from 147 to 272 feet; small supplies of good and medium water for stock purposes were obtained, but only one of the wells yielded water fit for domestic purposes. In 1908 boring was commenced in the Mallee country near the Border east of Pinnaroo in South Australia, and a line of bores from the Border to Kow Plains has proved the existence of a large sheet of underground water. Altogether, sixty-eight bores have been successful in striking fresh water, and their depths vary from 150 to 1400 feet, the water rising to within from 200 to 7 feet of the surface. In three instances the bores flow, the water rising from four to seventeen feet above the surface. The fresh water extends nearly as far east as the 142nd meridian, and its northern limit is approximately the 35th parallel. Information as to the geological formation of this district is given on page 492 preceding.

At the end of 1913 the number of existing Government bores in use in Victoria was 81, from which supplies are obtained by pumping. The total depth bored amounted to 32,665 feet, while the maximum and minimum depths at which water was struck were 675 and 131 feet respectively. There are also seventy-two existing private bores, with a total depth of about 162,000 feet.

4. **Queensland.**—A return relating to the 30th June, 1914, classifies the Queensland artesian bores under the following headings:—

QUEENSLAND ARTESIAN BORES ON 30th JUNE, 1914.

Sunk by—	Artesian Flows.	Sub-Artesian or Pumped Supplies.	In Progress, Abandoned, or Uncertain.	Total.
Government	45	30	138	213
Local governing authorities	14	13	15	42
Private owners	926	498	580	2,004
Total	985	541	733	2,259

Of the 985 flowing bores, 81 were of less than 10,000 gallons per day; 191 from 10,001 to 100,000 gallons; 381 from 100,001 to 500,000 gallons; 262 from 500,001 to 1,500,000 gallons; 64 from 1,500,001 to 3,000,000 gallons; and 6 from 3,000,001 gallons upwards. The deepest well was one known as Bimerah Run No. 3, White-wood, lying between the Barcoo and Thomson Rivers; this had a depth of 5045 feet, and was stated to yield 70,000 gallons daily. This flow is, of course, a comparatively small one, many wells yielding, when uncontrolled, from one to three million gallons a day. A well at Cunnamulla is stated to have a daily flow, when uncontrolled, of no less than 4,500,000 gallons. The waters of many of the wells have been analysed, and some found suitable for wool-scouring only, others are suitable for watering stock but not for irrigation, owing to the presence of alkali; others again serve for both stock and irrigation, while some, such as those containing sulphuretted hydrogen, are not of any use. Water fit for stock may generally be said to be "safe" for domestic purposes in spite of its slightly mineral taste. The wells yielding the mineral waters known as "Helidon Spa," "Boonah Spa," and "Junot Spa," which are much in use in Queensland and New South Wales, are shallow wells from 60 to 200 feet in depth.

The following table shews particulars as to Queensland bores at the end of June, 1914:—

QUEENSLAND ARTESIAN AND SUB-ARTESIAN BORES ON 30th JUNE, 1914.

Particulars.	State and Local Authorities.	Private.	Total.
Bores existing No.	255	2,004	2,259
Total depth bored feet	203,170	2,147,963	2,351,133
Daily flow gallons	30,911,475	475,591,025	506,502,500
Depth at which artesian water was struck—			
Maximum feet	4,256	5,045	...
Minimum "	354	10	...
Temperature of flow—			
Maximum °Fahr.	198	211	...
Minimum °Fahr.	85	81	...

5. **South Australia.**—There were in South Australia 125 bores existing at 31st December, 1913, of which 30 were artesian and 95 sub-artesian. There are 97 under 1000 feet in depth, 18 from 1000 to 2000 feet; four from 2000 to 3000 feet; four from 3000 to 4000 feet, and two over 4000 feet. The deepest flowing well was at Goyder's Lagoon, on the Hergott to Birdsville route, measuring 4580 feet, and yielding 600,000 gallons per day. A bore at Patchawarra, 35 miles north of Innamincka, has been sunk to a depth of 5458 feet, where operations have been stopped for the present. Water was struck in this bore at various depths down to 4000 feet. At that depth the water rose and ran over the surface at the rate of 400 gallons daily. Further sinking was carried on in the hope of getting a better supply, but, so far, without success. The maximum flow, viz., 1,250,000 gallons, is obtained at Coonie Creek, east of Lake Frome.

The following table shews particulars as to South Australian bores at the end of December 1913:—

SOUTH AUSTRALIAN BORES, 1913.

Particulars.	Artesian and Sub-artesian.
Bores existing	125
Total depth bored feet	87,714*
Daily flow gals.	†
Depth at which water was struck—	
Maximum feet	4,850
Minimum feet	233
Temperature of flow—	
Maximum °Fahr.	208
Minimum °Fahr.	82
Total cost of construction of bores up to end of year ...	£231,361
Expenditure during year on boring operations ...	£28,802

* Exclusive of abandoned bores.

† Not available.

(i.) **Bores along Bordertown Railway.** The sinking of bores across the Ninety-mile Desert between the Murray and the Victorian boundary was commenced in 1886 at Coonalpyn; with the exception, however, of salt water at 55 ft., none was reported to have been struck. Ki Ki bore was sunk in 1887, and at 361 ft. a good supply of water fit for stock was struck. Tintinarra bore was sunk in 1887; it was artesian when first tapped. The water was found to be fit for locomotive engines and is still used for that purpose. The bore at Emu Flat was also sunk in 1887.

In all these bores water was found in porous beds of Eocene (Tertiary) age.

(ii.) *Bores along and near Pinnaroo Railway Line.* Several bores have been successfully put down in the Pinnaroo country. In 1904 the first bore was sunk in this district at Cotton, and numerous successful bores have since been put down by the Public Works Department, and subsequently by the residents of the district. The depth of water level from the surface ranges from 15 to 320 feet, and the maximum outflow is 48,000 gallons per day at the Gosden bore. Several wells, ranging in depth from 55 ft. to 221 ft., have also been sunk in this district.

The latest Government bores are situated in the Hundreds of Molineux, Cotton and Kingsford. Each of these bores has a depth of 250 feet, and the water, which is in large supply, rises to within about 90 ft. of the surface. The water is fresh, containing about $\frac{3}{8}$ oz. salts and other solid matter per gallon.

(iii.) *Bores West of Oodnadatta.* A series of bores has been sunk, beginning with Broaden bore, 20 miles west of Oodnadatta, which was put down in 1911. The others since put down are Gypsum, Imbitcha, Mirackina and Raspberry Creek; of these the only artesian supply is at Raspberry Creek, where 1,000,000 gallons a day of good water is obtained. The depths of these bores range from 280 feet at Mirackina to 1122 feet at Broaden, and the water from all of them is good.

6. **Western Australia.**—The scheme by which the Government of Western Australia undertook to provide a permanent supply of water for the population on the eastern goldfields of that State comes properly under the heading of "Water Supply Works." A description of the scheme is fully given in previous issues of the Year Book. (See No. 6, p. 576.)

In August 1912 the administration of the Goldfields Water Supply and of the Mines Water Supply was transferred to a new department, the Water Supply, Sewerage and Drainage Department. The statistics in connection with this department will be found in the section of this book dealing with *Local Government*.

The following table shews particulars as to Western Australian artesian bores at 31st December, 1913 :—

WESTERN AUSTRALIAN ARTESIAN BORES, 1913.

Particulars.	State.	Private.	Total.
Bores existing	58	30	88
Total depth	73,290	29,632	102,922
Daily flow	22,784,700	8,176,700	30,961,400
Depth at which artesian water was struck—			
Maximum	4,016	*	...
Minimum	175	*	...
Temperature of flow—			
Maximum	140	*	...
Minimum	60	*	...

* Not available.

At the end of the year 1913 the total number of Government bores west of the Darling Range was 58, and there were 30 private bores recorded in addition. The total cost of construction of State bores at the end of the year 1913 was about £128,000, of which amount £4000 was spent in 1913. The maximum outflow, 4,000,000 gallons per day, was obtained at Leederville in connection with the Metropolitan Water Supply at 2097 feet.

The boring operations which have been carried out in the four artesian basins along the West Australian Coast, and which have been specified on page 491 are as follows :—

(i.) *The Coastal Plain Basin or Perth Area*, which, generally speaking, extends from Cape Leeuwin to Dongarra, and from which the Metropolitan Water Supply is largely drawn, yields a supply of water mostly fresh and suitable for domestic purposes, though towards the north it becomes brackish and is only suitable for stock purposes.

MAP SHEWING THE POSITION AND EXTENT OF THE "AUSTRALIAN
ARTESIAN BASINS."



This map was prepared by the Interstate Conference on Artesian Water, held in Sydney during May, 1912. It contains the latest facts relative to the various artesian basins of the Australian continent. Of these basins the most important is the Great Australian Basin, which is about 569,000 square miles in extent, viz.:—About 376,000 square miles in Queensland, 60,000 square miles in South Australia, 83,000 square miles in New South Wales, and 20,000 square miles in the Northern Territory. The Murray River Basin extends over South-Western New South Wales, North-Western Victoria, and South-Eastern South Australia. The Western Australian Basins fall naturally within five groups, viz.:—The Eucla Basin, the Coastal Plains Basin, the North-West Basin, the Desert Basin, and the Gulf Basin. (See also pages 491 to 499.)

There are fifty-six bores in the Metropolitan District, several of which have been put down to augment the hills supply, and the domestic supply of the suburbs and Fremantle is largely dependent upon this source.

(ii.) *The North-west Basin or Carnarvon Area* may be said to extend from Gantheaume Bay in the south to Onslow in the north, and embraces a very large tract of ideal sheep country.

Many private bores have been put down on sites which permit of the gravitation of the water for miles, and, by this means, a very considerable area has been put under stock. Some remarkable flows have been obtained and, in one case, at a depth of 300 feet a flow reputed to be 3,000,000 gallons per day was struck, the water being good stock.

In all some 25 bores have been put down.

(iii.) *The Gulf Basin or Broome Area.* So far very little development work has been done. Artesian bores have been put down in the town site, and the domestic requirements of the town are entirely supplied from this source.

The area extends from Condon in the south-west to the Meda River beyond Derby in the north, and for a considerable distance inland.

So far only five bores have been sunk, two being at Broome and two at Derby, and the other on the telegraph line on the road between Derby and Hall's Creek, about 67 miles inland.

(iv.) *Eucla Area.* This area extends from Eucla on the South Australian border, west of Israelite Bay. So far, beyond the bores put down on the survey line of the Trans-Australian Railway, very little has been done in proving the resources of this area.

In 1902 the first bore was sunk, about 35 miles north of Madura, and sub-artesian water struck at 430 feet, at an elevation of 400 feet above sea level.

Following upon this a deep bore was put down at Madura, below the cliffs and nearer the coast, when an artesian supply of stock water was obtained at a depth of 2101 feet, yielding 31,000 gallons per day.

This was followed later with four bores along the survey line of the proposed railway, which runs east and west about 90 miles inland, when two bores were sunk near the 337 mile peg and sub-artesian water struck at 300 feet. One bore was carried down to 1,344 feet and the other to 412 feet. In both instances good stock water was obtained.

Other two bores were sunk on the line about 40 miles west of the South Australian border and similar results obtained, the bores being carried down to 371 feet and 996 feet respectively.

7. Northern Territory.—In the Northern Territory, bores to the number of 62 have been put down, seven belonging to the Commonwealth Government and situated in the Darwin district. The 55 private bores are all situated in the Barclay Tableland. The cost of construction to 31st December, 1913, was Government bores £2022, and private bores £71,800.

The following table gives further particulars of the Northern Territory bores at 31st December, 1913 :—

NORTHERN TERRITORY BORES, 1913.

Particulars.	State.*	Private.†	Total.
Bores existing	7	55	62
Total depth bored	1,206	19,682	20,888
Daily flow	42,061	2,542,400	2,584,461
Depth at which water was struck—			
Maximum	213	502	...
Minimum	110	128	...
Temperature of flow—			
Maximum	‡	‡	...
Minimum	‡	‡	...

* Situated in Darwin district. † Situated in Barclay Tableland. ‡ Not available.

2. Irrigation Plants.

1. **General.**—Australia's first experiments in irrigation were made with the object of bringing under cultivation areas in which an inadequate rainfall rendered agricultural and even pastoral occupations precarious and intermittent, and, although these original settlements have for the most part proved fairly successful, most of the States, instead of promoting new settlements in unoccupied regions, are adopting the policy of making existing settlement closer, by repurchasing big estates and large farms, subdividing them into holdings of suitable sizes for cultivation, and selling the land upon easy terms of payment. It is in connection with this Closer Settlement policy that the special value of irrigation is recognised.

2. **New South Wales.**—(i.) *Water Conservation and Irrigation.* Since the 1st January, 1913, irrigation has been recognised in the State of New South Wales as of sufficient importance to warrant the formation of an entirely separate department, the head of which is the Commissioner for Water Conservation and Irrigation.

The provision of an adequate water supply for other than domestic purposes is essential to the well-being of all primary industries, and particularly in a country which is liable to dry seasons which affect extensive areas. Much of the area of the State receives an adequate and regular rainfall, but over a considerable extent of country all the factors exist which are requisite to success in agricultural pursuits except a constant water supply. The recognition of the fact that the area suitable for cultivation might be extended largely by a comprehensive system of water conservation and irrigation has led the State to undertake various schemes in detached groups, which will constitute portion of the ultimate irrigation system necessary to serve the whole State.

(ii.) *Murrumbidgee Irrigation Scheme.* The main features of the work include a storage dam across the Murrumbidgee to retain the floodwaters, which will be released for use lower down the river during the dry summer months; a movable diversion weir, about 220 miles below the dam, to turn the required amount of water from the river into the main canal; a main canal, leaving the river near the weir; a main branch canal; and a series of subsidiary canals and distributing channels through the area to be irrigated.

The site of the storage dam is at Burrinjuck, three miles below the confluence of the Murrumbidgee and Goodradigbee Rivers. The dam wall is being constructed of cyclopean masonry and concrete, and when completed will have a maximum height of 240 feet, and will impound the waters in a lake covering 12,740 acres. Sufficient water is being stored to meet the requirements of the farms already occupied. The reservoir will have a capacity of 33,381 million cubic feet, the catchment area being about 5000 square miles, drained by three principal streams—the Murrumbidgee, Goodradigbee, and Yass Rivers—up which the water will be backed, when the dam is full, to distances of 41 miles, 13 miles, and 11 miles respectively. Direct communication between Burrinjuck and the Main Southern railway has been provided by the construction of a 2-foot gauge line from Goondah, a distance of 26 miles.

The diversion weir being designed for irrigation purposes, the supply is regulated, in the first place, from Burrinjuck dam, and then at the weir, by means of sluices. The weir is situated at Berembed, about 40 miles by river and 19 miles in a direct line above the town of Narrandera. It is founded on a solid granite bar extending across the river, and has a length over all of 270 feet between abutments, divided into a sluiceway 40 feet wide in the clear; a lock chamber, 40 feet wide, capable of taking barges up to 100 feet in length; and 55 movable wickets, manipulated from a punt moored up-stream. The weir and regulating works have been completed.

The main canal branches from the river just above the weir, and, after passing through Narrandera, continues in a north-westerly direction, skirting the hills abutting on the plains. A scheme for enlarging the main canal to double its present capacity is now being investigated by the Public Works Committee. There are two main branch

canals, viz., the Gogeldrie canal, which offtakes at 47 miles from Berembé, and runs approximately parallel to the Narrandera-Hay railway through the Yanco Area, and the Mirrool branch, which offtakes at 78 miles from Berembé and supplies portion of the Mirrool Area.

The scheme, as described above, applies only to the land on the northern side of the Murrumbidgee River. It was originally intended to provide a canal to supply the land on the southern side, but subsequently it was decided to apply all the water available from the Burrinjuck Dam to the northern areas, these lands being eminently suitable for irrigation. For this reason the main canal is to be enlarged, and when complete will be capable of supplying an area of about 250,000 acres, which, in the opinion of the experts, may be worked profitably in small subdivisions devoted to mixed farming, dairying, and stock raising, or fruit and vegetable growing, tobacco culture, etc. In addition, there is an area of about a million acres to be set aside for use as "dry" lands in conjunction with those under irrigation. When the areas are fully settled it is estimated that there will be nearly 7000 farms and 100,000 people. By means of irrigation the soils and climate of these areas are suitable for the production, with most profitable results, of apricots, peaches, nectarines, prunes, pears, nuts, almonds, melons, cantaloups, and citrus fruits, also wine and table grapes, raisins, sultanas, figs, olives, and most varieties of vegetables. Other products are tobacco, lucerne, and fodder crops, such as sorghum, maize and millet. Dairying, pig-raising, mixed farming, and ostrich farming are already being successfully undertaken.

The Murrumbidgee Irrigation Act, passed in December 1910, constituted a trust for the administration of the scheme, and provided the necessary authority for the acquisition of land, construction of improvements, levying rates, and generally for administering the irrigation areas and work. This Act was repealed in December 1912; and the whole scheme is now under the control of a Commissioner of Water Conservation and Irrigation.

The lands acquired for irrigation under the provisions of the Act include the North Yanco estate, the Gogeldrie holding, and various holdings in the Brobenah and Mirrool Creek districts—the total area resumed to 30th June, 1914, being about 312,100 acres, at an estimated cost of £827,430.

The first area made available for settlement was in the vicinity of Yanco Siding on the Hay railway line. The second, which is situated on the northern side of the Mirrool Creek, will be served by an extension of the railway from Barellan, which will be completed early in the year 1915.

There are available farms varying in size from 2 acres to 200 acres. The smaller farms—2 acres to 15 acres—are designed to meet requirements of the vegetable grower, the small orchardist, the farm laborer, and, in some cases, the business man of the adjoining towns. Each acre has a permanent water-right attached to it, *i.e.*, a right to such a quantity of water, 12 inches deep, as would cover an area of one acre. To satisfy the requirements of the man with large capital, and also as a means of providing employment for the man possessed of lesser means, farms with 100 water-rights attached may be obtained under certain special conditions, one of which is that the holder must expend within the first two years of his occupation an amount of not less than £6 per acre in connection with the improvement of his holding—such improvements to be exclusive of the value of his homestead and out-buildings. Although a condition of residence attaches to every lease, suspension of residence may be allowed by the Commissioner. This permits of an intending settler having a farm developed for him for four or five years by the Commissioner or a private contractor. In this way the early preparation work is personally avoided by the lessee, who is thus enabled to take possession when his orchard or vineyard is in full bearing.

Areas of non-irrigable or "dry" lands, in the proportion of double or three times the irrigable area taken up, are available for the depasturing of stock, and may be acquired either as additional holdings for the individual, or as a commonage for the joint use of groups of settlers.

The conditions for the disposal of irrigation blocks are contained in the Crown Lands Consolidation Act of 1913, and the Crown Lands and Irrigation (Amendment) Act of 1914.

Any male over the age of 16 years, or female over 18 years (other than a married woman not living apart from her husband under decree of judicial separation), or two or more such persons jointly, may apply for a farm or block. The tenure is perpetual leasehold, rent being charged at the rate of 2½ per cent. on the capital value.

The improvement conditions attached to the farm holdings include fencing, planting of trees for windbreaks, construction of dwellings, destruction of noxious plants, and the cultivation of a specified area in each year.

The assistance granted to settlers is both practical and liberal. Aid is given in connection with the erection of homesteads, barns and outbuildings, the degree of assistance varying according to the size of the holding. Repayments for assistance in this direction may be spread over 12 years. The construction of head ditches or other work entailed in the actual practice of irrigation is carried out on the settler's behalf; repayments for this form of assistance may be spread over a period of 10 years. Fencing posts are available for purchase on 10 years' terms. Fruit trees and vines may be purchased from the Government Nursery. The terms of repayment for these have been determined, having regard to the time when the settler will obtain revenue from his cultivation work. Lucerne seed is supplied during a settler's first planting season. A settler who may adopt dairying as a "pot-boiler," whilst fruit trees or vines are coming into bearing, or as a permanent revenue producer, is assisted in the purchase of dairy stock. The amount of help given depends on the quantity of planted feed a settler has in sight. A deposit is payable in respect of each cow purchased, the payment of the balance being by monthly instalments spread over two years. Machinery and implements may be hired at reasonable rates, and expert labour will, if desired, be provided at the settler's expense. Pedigree bulls may be leased. The Government Savings Bank Commissioners have statutory power to make loans upon a mortgage of irrigation farm leases, although the condition of the money market, consequent on the state of war now existent in Europe, is restricting advances for the time being. Concessions in railway fares and freights are made on New South Wales railways to *bonâ fide* applicants for land. At present the annual charge for water supply has been fixed at 5s. per water-right, but this charge is reduced to one-half for the first year, and is then increased yearly by sixpence per water-right, so that a settler is not required to pay the full charge until he is in the sixth year of occupation. The assistance granted may be altered from time to time.

Townships have been established at centres of the Yanco and Mirrool areas; the Commissioner is empowered to construct streets, and to provide water supply and other services.

A butter factory, equipped with the latest plant and with the capacity for dealing with the product of 10,000 cows, has been established. Cash payments are there made monthly for cream supplied by the settlers, who are thus assured of an immediate and regular income, and placed in the position to turn their attention to other forms of farming, if they so desire. A large up-to-date vegetable and fruit canning factory has also been provided, at which vegetables and fruits grown by the settlers are purchased from them. A bacon factory and cheese factory are in course of erection. A State demonstration farm and nursery are in operation, and various commercial crops are tested as to their suitability for local cultivation. The process of treatment and the preparation for market of the different products are fully investigated, and the experience thus gained is at the disposal of settlers, free information and instruction being afforded on all agricultural matters and irrigation methods. An electric power-house has been erected near Yanco Siding; electric light and power are supplied to the business people, and are available for settlers when the number of applicants warrants the connections.

From the date of the first subdivision in July 1912 to 31st December, 1914, 805 farms had been granted, representing a total area of 36,015 acres, the settlers on which have a declared capital of £447,029.

In addition, 114 township and village blocks have been granted, and 259 miles of roads, 289 miles of reticulation channels, and 197 miles of drains have been constructed.

In the matter of cultivation, the following particulars indicate the extent of the work performed by the settlers:—750 acres under stone fruits, 200 under vines, 150 under trees, 3750 under lucerne, 10,000 under other fodder crops, and 350 acres under vegetables. The estimated population of the irrigation area is about 4750 persons. The rents payable amount to £14,850; the annual total revenue, including £6900 for water rates, being £21,750.

(iii.) *Other Irrigation Schemes.* The following proposals are under investigation by the Water Conservation and Irrigation Commission:—

- (a) *Murray River.* The Burrinjuck dam on the Murrumbidgee River in New South Wales and the storages on the Upper Goulburn River in Victoria are the only works at present in operation for regulating the flow of the Murray River. The conflicting interests of the three States interested in the use and conservation of the Murray waters are referred to at length in a later part of this section (see page 507).
- (b) *Darling River.* A preliminary investigation has been made of the Darling River, which shows that the most suitable site for the storage of large volumes of water for irrigation purposes is in the Lake system to the east of the river, comprising Lake Boolabooka, Ratecatcher's Lake, and Victoria Lake, and a number of other lakes fed from the river in high floods from the Talywalka Creek, which takes off from the river about 260 miles above Menindie. A large area of high-class land can be commanded from this storage, and this area will be served by the Condobolin-Broken Hill railway when constructed.
- (c) *Lachlan River.* The construction of a storage reservoir at Wyangala, below the confluence of the Abercrombie River, has been investigated with the intention of affording water in the river channel for pastoral purposes and for the irrigation of small areas along the river bank by pumping. In view, however, of the unsatisfactory nature of the run-off from this catchment, it is unlikely that the scheme will be further considered at present; but an alternative proposal is being investigated for the increase of the storage in Lake Cudgellico, which is fed from the Lachlan River, and for the pumping thence of the water for the irrigation of an area adjacent to the lake.
- (d) *Macquarie River.* The construction of a storage reservoir has been proposed on this river at Burrendong, below the confluence of the Cudgegong River, for the purposes of affording water by gravitation for the irrigation of certain lands to the west of Narromine. A smaller scheme, which has received consideration also, is the construction of a storage dam on Campbell's River at Bathurst. The run-off from this catchment is too uncertain to permit of the construction of any large irrigation scheme, but perennial supplies can be made available for the use of individual irrigators by the construction of storage works on this river and also on the Namoi, Peel, Gwydir, and McIntyre Rivers.
- (e) *Hunter River.* A scheme has been prepared for supplementing the water supply of the Hunter River District, and providing water for irrigation, by means of pumping on the area adjacent to the Hunter River, which is one of the most fertile districts in the State, and is capable of carrying a dense population under the conditions of intense culture by irrigation. Alternative proposals have been investigated for the construction of a storage dam, either on the Upper Hunter or Goulburn Rivers, and an examination has been made for storage sites on the whole of the tributaries of the Hunter River. It is probable that this matter will be considered shortly by the Public Works Committee, together with an alternative proposal for supplying water from the Namoi River.

(f) *Warragamba River.* The Warragamba project will serve the dual purpose of amplifying the Sydney water supply, and irrigating the best lands in the Hawkesbury Valley. The percentage increase in the population of the metropolitan area during recent years, if maintained, will, in a short space of time, cause the consumption of water to overtake the capacity of the present catchment area of the Sydney water supply, and the next available source of supply will then be the Warragamba River, a scheme for the storage of water from which has been prepared. It is proposed to construct a large storage dam capable of supplying at least 80 million gallons daily for domestic service, 30 million gallons daily for trade purposes, and 80 million gallons daily for irrigation purposes in the Hawkesbury Valley. The waters made available by this project will be so valuable that they can be applied only to the highest class lands for irrigation purposes, and the area to be served will accordingly be limited to probably about 30,000 acres in the vicinity of the Nepean and Hawkesbury Rivers. Surveys are being made and details prepared of the irrigation portion of the scheme for submission to the Public Works Committee.

(iv.) *Irrigation Settlements.* Irrigation settlements have been established at Hay and at Wentworth, and were, in 1913, placed under the control of the Commissioner for Water Conservation and Irrigation. In Wentworth irrigation area, embracing 10,600 acres, 1520 acres have been subdivided into 107 blocks; 1377 acres are held under lease in 94 blocks; the balance is still available for lease. During 1913-14, 1000 acres were under cultivation, the greater part being devoted to fruit trees, oranges, grapes, sultanas, and currants. In this area is instituted a dual scheme of irrigation and intense cultivation of small areas, and the results of the experiment will be regarded with interest, as of exceptional value from the educational standpoint. The pumping machinery consists of a suction-gas plant, supplying two engines of about 55 brake horse-power each, working two centrifugal pumps, with an average combined capacity of about 4600 gallons per minute. With eight pumpings during the 1913-14 season, 144,172,050 cubic feet of water were supplied, and the results achieved by the settlers on this area have been highly satisfactory. The length of the main channels is about 4 miles 24 chains, and of subsidiary channels 4 miles 31 chains; total length, 8 miles 55 chains. The land may be leased for periods not exceeding 30 years. The rents vary from 1s. to 5s. per acre; the rate for water varies from 10s. to 20s. per acre. Each lessee is entitled to receive a quantity of water equivalent to a depth of 30 inches per annum, limited to 4 inches in any one month.

The Hay irrigation area consists of about 3842 acres, and previous to 1912 was controlled by a Trust appointed in 1897. The area held and used for irrigation purposes is 940 acres by 70 holders. The lands may be leased for periods not exceeding 99 years. The rentals vary from 5s. to 10s. per acre. The water-rate is fixed half-yearly, the present rate being 10s. per acre. The pumping machinery is, however, similar to that employed at Wentworth, the capacity of the pumps being 4000 gallons per minute. During the 1913-14 season 595,212,009 gallons of water were supplied.

(v.) *Water Rights.* The Water Act 1912 consolidates the Acts relating to Water Rights, Water and Drainage, Drainage Promotion and Artesian Wells. Part II. of the Act vests in the Crown the right to the use, flow, and control of the water in all rivers and lakes which flow through or past, or are situate within the land of two or more occupiers. It abolishes "riparian rights," and establishes a system of licenses for works of water conservation, irrigation, and drainage. Prior to the passing of the Act relating to Water Rights, such works on creeks and rivers, constructed by private individuals, were liable to destruction by any person who considered their existence opposed to his interests. It is now illegal to interfere with any work for which a license has been granted. The security provided is stimulating the construction of irrigation works of a better class throughout the State, and up to the end of December 1914, 3294 applications for licenses have been made under the Act.

3. *Victoria.*—(i.) *Classification of Works.* The Water Conservation Works in Victoria naturally divide themselves into those providing mainly a domestic supply, such as the Yan Yean works, controlled by the Melbourne and Metropolitan Board of Works; the Coliban, Broken River, Kerang Lakes, and Mallee Supply Works, which, although now administered by the State Rivers and Water Supply Commission, are properly local government works; other works for domestic supply controlled by Water Works Trusts or Municipal Corporations; and irrigation works proper. With the exception of the last-named class, particulars as to these works will be found in the section on "Local Government" of this book.

(ii.) *Works Controlled by the Commission.* With the exception of the First Mildura Irrigation and Water Supply Trust, all of the irrigation schemes and the more important domestic and stock water-supply works in rural districts are vested in and controlled by the State Rivers and Water Supply Commission, which was created by the Water Act 1905, in force since 1st May, 1906. The works under the control of this body, which is composed of three members, may be classified as follows:—(a) Irrigation schemes; and (b) Domestic and stock schemes, included in which are a number for providing town supplies, the principal being the Coliban system.

(a) *Irrigation Schemes.* This division comprises the schemes constructed and under construction for the supply of water to between twenty to thirty irrigation districts. Up to 1906 these schemes were controlled by local Trusts which had obtained the moneys for their construction on loans from the State. By the Water Act 1905 all local control was abolished and the districts were transferred to the State Rivers and Water Supply Commission. Since that date the Government has adopted a vigorous irrigation policy and the capital expenditure at 30th June, 1913, on water supply in the irrigation and water supply districts under the control of the Commission was £4,699,474. The irrigation works draw their supplies mainly from headworks constructed on the Murray, Goulburn, and Loddon rivers. The cost of these works, which now stands at £1,198,097, is not debited to the districts benefited, but is borne entirely by the State. Within the last four years the State has adopted the policy of purchasing large areas of land commanded by these schemes and subdividing them for intensive culture. The settlement of the areas on these lines will mean a large increase in the population of the State. The management and supervision of these areas were formerly vested in two bodies—the Closer Settlement Board and the Water Supply Commission, but in order to do away with this dual control, the Amending Closer Settlement Act of 1912 was passed, transferring to the Water Supply Commission the entire management, leasing, and general supervision of all lands within irrigation districts. Pending the ratification of the resolutions adopted at the Premiers' Conference 1914, relative to the control, conservation, and use of the Murray River (see page 507), the commission has co-operated with the Water Conservation authorities of New South Wales in testing suitable storage sites on the Upper Murray as recommended by the Interstate Conference of Engineers in July 1913.

(b) *Domestic and Stock Schemes.* The second division takes into account the schemes constructed and under construction for the supply of water for domestic and stock purposes. The area of country lands artificially supplied with water for these purposes is nearly 21,000 square miles. The number of towns supplied, exclusive of the City of Melbourne and its suburbs, is 148, serving an estimated population of 291,000. The principal works of this division are situated in the Wimmera and Mallee districts, and cover an area of over 6000 square miles. In addition to the Commission's districts some large areas are still administered by local authorities.

It should be mentioned that in 1899 the State deemed it advisable to write off the sum of £1,073,000 from capital accounts of the local bodies then controlling the works in each of the above divisions.

(iii.) *Mildura.* The first settlement of Mildura dates from 1884. After being managed until 1887 by Chaffey Bros., and then until 1895 by the Mildura Irrigation Company Limited, it was in that year taken over by the First Mildura Irrigation Trust under special Acts of Parliament, and has since then made great progress. Its population

at the Census of 1911 was 6145. Water is pumped from the Murray River by five pumping stations, collectively raising 8,000,000 gallons per hour. The length of the main irrigation channels is 280 miles. For the year ending 30th June, 1914, the receipts of the Trust aggregated £33,701, and its expenditure £32,908. For the same period the area of land under cultivation and the record of water acres were 12,307 and 39,541 acres respectively, the value of the fruit crops for the year being about £400,000.

No precise figures are available as to the capital cost of the works at Mildura; probably the sum was not less than £180,000. The amount due to Government is £72,451, exclusive of £12,659 for accumulations of interest.

(iv.) *Lands supplied with Water within the State.* The area of country lands within the State artificially supplied with water for domestic and ordinary use and for watering stock is approximately 20,500 square miles, equal to about 13,120,000 acres. The extent of land under irrigated culture, for all kinds of crop, is 249,983 acres, an increase of 20,150 acres over the area irrigated in the previous year. The above total includes about 14,500 acres, watered under yearly permits granting authority to divert water from streams throughout the State. Further progress has been made during the year in bringing all such diversions under the control of the Commission, 719 permits authorising diversions for irrigation, domestic and stock, and power purposes being now in force.

1. **Queensland.**—The main irrigation works in Queensland are as follow:—(a) those at Ayr, which utilise the waters of the Burdekin River, and shallow wells on its banks; (b) those at Bingera, near Bundaberg, which utilise water pumped from the Burnett River just above the point of meeting of the salt and fresh waters, and (c) those at Fairymead, which utilise water pumped from a number of shallow spear wells sunk on the alluvial flats on the north side of the Burnett River and about six miles from Bundaberg. There were 657 irrigators in the State in 1913, chiefly farmers and graziers, and the area irrigated was 11,904 acres.

5. **South Australia.**—(i.) *The Renmark Irrigation Trust.* The Renmark Irrigation Trust was established in 1893 on similar lines to Mildura, but on a smaller scale. At present the extent of the land assessed for the purpose of the trust is approximately 5200 acres, and maintains a population of 2500. The value of Renmark products has now reached the sum of over £135,000 per annum. It is claimed that without irrigation the land would barely feed 500 sheep.

(ii.) *Other Waterworks.* A number of country water works are under the control of the Public Works Department. As, however, they are not irrigation works properly so called, but are used for supplying water for domestic purposes, etc., to several towns, no further reference will be made to them in this chapter. (See Section XXVI., *Local Government.*)

(iii.) *Area under Irrigation.* Until 1910, irrigation in South Australia, with the exception of the schemes already mentioned, made little, if any, progress; but in that year an Irrigation and Reclamation Works Department was created, and the first report of the Director has now been issued. The Government is at present proceeding with the irrigation schemes along the Murray as fast as possible. The Cobdogla station, formerly held under grazing permits, has been resumed by the Crown, and as a result of the surveys to 30th June, 1914, 30,745 acres at Cobdogla and 9645 acres at Berri have been found available for irrigation. The Cobdogla area comprises practically the whole of the original Lake Bonney irrigation scheme, and is contiguous to the Berri irrigation area. The reticulation with channels for an area of 122,000 acres, between the Cobdogla home-stead and Lake Bonney, which lends itself to economical irrigation, is already well advanced. This area will be watered by means of two Humphrey pumps, with a capacity of 500,000 gallons per hour each, and a lift of about 40 feet.

This plant will also supply an additional 7000 acres at the 70-foot level. Other pumping plants will be erected at the north and south ends of Lake Bonney, and at the river at Cobdogla woolshed.

In the section dealing with Closer Settlement (page 251) the subject of irrigation areas in South Australia has already been referred to.

6. Western Australia.—An Irrigation Act has been brought into force providing for the constitution of Irrigation Districts. Surveys have been completed and actual work commenced for irrigating about 4000 acres at Harvey. The area is devoted chiefly to fruit growing, principally oranges. Numerous small private irrigation schemes are in full operation on many of the south-west rivers in connection with fruit growing, fodder crops, and potatoes.

7. Murray Waters.—The relative rights of the States of New South Wales, Victoria, and South Australia to the waters of the Murray River are undetermined. Territorially the south bank of the Murray was the boundary between the two former States, *i.e.*, the region of the River itself, up to the point where it enters South Australia, was wholly within New South Wales.

At the Federal conventions which preceded the establishment of the Commonwealth, the South Australian representatives expressed their fear lest too much irrigation on the Murray and Darling might impair the navigability of the latter river, and the result was the insertion of a provision in the Commonwealth Constitution which reads as follows:—
“*Section 100.*—The Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State or the residents therein to the reasonable use of the waters of rivers for conservation and irrigation.”

Under this section negotiations have for several years been in progress between the three interested States. In January 1911 a conference took place in Melbourne between the Premiers of New South Wales, Victoria, and South Australia on the Murray Waters question. Briefly stated, the results of the conference were that South Australia was to be allowed to carry out storage works at Lake Victoria, New South Wales, and lock her own portion of the Murray at her own expense, but New South Wales and Victoria would not recognise the claims of navigation in any way, and would not bind themselves to deliver any quantity of water at the point of intake into South Australia. No rights to navigation were conceded by New South Wales and Victoria, and the upper portions of the river were left free for irrigation.

In 1913 the three States appointed a board of engineers to carry out investigations, with a view to ascertain means which would be conducive to a settlement of the question of the River Murray and its tributaries. The board in its report stated that it was agreed that the interests of irrigation are more important than those of navigation, and that the heavy expense of maintaining the latter is not warranted. In Year Book No. 7 (page 510), will be found the suggestions of the Board relative to the apportionment of the cost of works and of water between the three States. In April 1914, on the occasion of the Premiers' Conference in Melbourne, the following resolutions were agreed to by the Prime Minister of the Commonwealth and the Premiers of New South Wales, Victoria, and South Australia:—

“With a view to the economical use of waters of the River Murray and its tributaries, for irrigation and navigation, and to the reconciling of the interests of the Commonwealth and the riparian States, it is resolved that an agreement between the Commonwealth and States of New South Wales, Victoria, and South Australia (herein called ‘this Agreement’) be entered into, providing:—

(i.) That a system of storages be provided at Cumberoona or some other suitable site on the Upper Murray and at Lake Victoria, and that weirs and locks be constructed in the course of the River Murray from its mouth to Echuca; in the River Murrumbidgee from its junction with the River Murray to Hay, or alternatively to works in the River Murrumbidgee, an equivalent extent of weirs and locks in the River Darling, extending upstream from its junction with the River Murray.

(ii.) That the cost of the undermentioned works required to give effect to Resolution (i.), is estimated as follows:—

Nine weirs and locks from Blanchetown to Wentworth	...	£865,000
Seventeen weirs and locks from Wentworth to Echuca	...	1,700,000
Nine weirs and locks from the junction of the Rivers Murray and Murrumbidgee to Hay, or alternatively an equivalent amount (£540,000) in locks and weirs from the junction of the River Darling with the River Murray upstream	...	540,000
Upper Murray storage	1,353,000
Lake Victoria storage	205,000
		<u>£4,663,000</u>

be borne to the extent of £1,000,000 by the Commonwealth, and as to the remainder in equal shares by the States of New South Wales, Victoria, and South Australia.

(iii.) That, if so desired by the State of New South Wales, there shall be substituted for the proposed weirs and locks in the River Murrumbidgee locks and weirs to the same estimated cost in the River Darling upstream from its junction with the River Murray.

(iv.) That the flow of the River Murray at Albury, including the natural or regulated flow of the Rivers Mitta and Kiewa, and as regulated by the Cumberoona storage, be shared equally by New South Wales and Victoria, subject to any quantity hereby agreed to be sent down the river for riparian use and for supply to South Australia.

(v.) That New South Wales and Victoria each have full use of her own tributaries below Albury, and have the right to store and divert the flows thereof, or alternatively, equivalent volumes from the River Murray below their affluences subject to provision from such tributaries, or her share of the flow at Albury, or both, of contributions towards the share hereby allotted to South Australia, and the allowance for riparian use on the main stream from the affluence of such tributary, or from Albury to Lake Victoria.

(vi.) That the proportion of the contribution by New South Wales and Victoria to the share hereby allotted to South Australia, and for riparian use in the main stream, be that which the mean natural flow of the tributaries of each State below Albury measured at the points of affluence with the River Murray, with half the actual mean flow at Albury added in each case, bear to each other. In calculating the mean flow of the River Darling for this purpose a deduction shall be made to the extent of any water diverted by the State of Queensland.

(vii.) That the minimum quantity to be allowed to pass to South Australia in each year be sufficient to fill Lake Victoria storage once, and in addition to maintain, with the aid of the water returned from Lake Victoria, a regulated supply at Lake Victoria outlet of 134,000 acre feet per month during the months of January, February, November, and December; 114,000 acre feet per month for the months of March, September, and October; 94,000 acre feet per month for the months of April, May, and August, and 47,000 acre feet per month for the months of June and July, these being the provisions for irrigation equivalent to a regulated supply of 67,000 acre feet per month for nine months, and for domestic and stock supply, losses by evaporation and percolation in Lake Victoria, like losses and lockage in the river from Lake Victoria to the river mouth (but not including Lakes Alexandrina and Albert). Provided that these allowances and the allowance to the upstream States be reduced *pro rata* in such abnormal seasons as those of 1902 and 1903.

(viii.) That after the utilisation by South Australia for irrigation of the volumes set forth in Resolution (vii.), or after the utilisation by New South Wales and Victoria of 1,957,000 and 2,219,000 acre feet per annum respectively, whichever may first happen, a further volume may be allotted out of any surplus over the above specified allotments to the State of New South Wales, Victoria or South Australia, as the case may be, such further volumes to be determined by the Commission provided for herein.

(ix.) That the agreement entered into between the Premiers of New South Wales, Victoria, and South Australia, dated the 12th day of January, 1912, respecting storage works at Lake Victoria and certain works in, on, and near the River Murray, be confirmed, subject, however, to the modifications arising out of this agreement.

(x.) That the cost of any works jointly constructed by the States of New South Wales and Victoria in the River Murray above Echuca, for the purpose of diversion of water allotted to them under this agreement, shall be borne by the States of New South Wales and Victoria in proportion to the volume of water proposed to be diverted into each of said States by such works.

(xi.) That a Commission of four members to be called the River Murray Commission be appointed immediately after the ratifying of this agreement by the Commonwealth and States Parliaments concerned, one commissioner to be appointed by the Governor-General of Australia, one by the Governor of New South Wales, one by the Governor of Victoria, and one by the Governor of South Australia. The Commission shall carry into effect the provisions of this Agreement.

(xii.) That the works provided for in Resolution (ii.) be constructed by the State of South Australia from Blanchetown to Wentworth, by the State of New South Wales on the Murrumbidgee or Darling, as the case may be, and by the States of New South Wales and Victoria on the River Murray, under the direction of the Commission provided for herein and subject to the approval of all designs by the said Commission.

(xiii.) That the construction of the works mentioned in Resolution (ii.) of this agreement shall be commenced by each of the States, as provided in Resolution (xii.), as soon as may be after the ratification of this agreement by the Parliaments of the Commonwealth and the States respectively, and vigorously proceeded with until completion.

(xiv.) And that this agreement be submitted for ratification to the Parliaments of the Commonwealth and the States respectively during the next sessions of the said respective Parliaments, and is subject to such ratification."

In accordance with resolution xiv., this agreement is now under consideration of the Commonwealth Parliament and the Parliaments of the three interested States. In New South Wales, pending the results of the investigation of the dam foundations of the proposed storage dam at Cumberoona, surveys are being made by officers of the Water Conservation and Irrigation Commission of the lands on the New South Wales side of the Murray River which are capable of irrigation from that stream. The lands suitable for irrigation are much in excess of the area which can be served by the volumes of water which will be available, and it is therefore necessary that the most suitable and high-class land shall be selected for that purpose. So far as South Australia is concerned, the construction of the first lock at Blanchetown is practically now in progress, as the machinery required in the construction of it is being erected, and the necessary data for determining the sites of the other works included in that State's portion of the general scheme has been obtained.