CHAPTER XIX.

WATER CONSERVATION AND IRRIGATION.

§ 1. Artesian Water.

1. **General.**—In every country subject to droughts, the provision of adequate systems of water conservation is a matter of prime importance. Much has been done in Australia so far as the supply of water to centres of population is concerned, and a description of the principal water-works in each State will be found in Chapter XXII. "Local Government."

Interstate Conferences on the subject of artesian water were held in 1912, 1914, 1921, 1924 and 1928, when combined Governmental action was agreed upon with reference to delimitation of the artesian basins, hydrographic surveys, reason for decrease in flow, analyses and utilization of artesian water, etc. A map showing the extent of the known artesian basins will be found on pp. 515-6.

2. **The Great Australian Artesian Basin.**—The area known as the "Great Australian Artesian Basin," 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 (shown approximately by the map on pp. 515-6) is said to be the largest yet discovered, and measures about 600,000 square miles, of which 376,000 square miles are in Queensland, 118,000 square miles in South Australia, 80,000 square miles in New South Wales, and 25,000 square miles in the Northern Territory. The area of the intake beds is estimated at 60,010 square miles, comprising 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 Official Year Book (see No. 6, p. 569).

3. **The Western Australian Basins.**—The Western Australian Basins fall naturally within five distinct groups, namely, the Eucla Basin, in the extreme south-east of the State, 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 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. 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 variation 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.

4. **The Murray River Basin.**—The Murray River Basin extends over south-western New South Wales, north-western Victoria, and south-eastern South Australia. It 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 Range, 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 the river bed from beneath the limestone cliffs from Pyap Bend downwards. Similar springs exist along the courses of other branches of the River Murray system, where they cut through the tertiary formation. On the Victorian side, bores have been put down, and water has been struck at various levels.

5. **Plutonic or Meteoric Waters.**—In previous issues of the Official Year Book will be found a statement of the theory of Professor Gregory* as to the origin of the water in the Australian artesian basins, together with the objections held thereto by a former Government Geologist of New South Wales.† (See Official Year Book No. 6, p. 570.)

6. **Artesian and Sub-Artesian Bores.**—(i) *General.* The following table gives particulars regarding artesian and sub-artesian bores in each State and in the Northern Territory :—

ARTESIAN AND SUB-ARTESIAN BORES, 1938-39.

Particulars.	N.S.W.	Vic.	Q'land.	S. Aust. (a)	W. Aust.	N. Terr.	Australia.
Bores existing .. No.	737	620	6,774	162	281	191	(b) 8,765
Total depth of existing bores feet	c1,132,322	30,000	4,839,000	115,598	229,391	63,375	b6,409,686
Daily flow 1,000 gals.	(d)67,349	2,500	250,000	12,972	(e)	7,723	(b)340,544
Depth at which artesian water was struck—							
Maximum .. feet	4,338	3,560	6,000	4,851	4,006	1,760	6,000
Minimum .. feet	100	20	10	233	30	42	10
Temperature of flow—							
Maximum .. °Fahr.	140	120	212	208	(e)	(d)	(b) 212
Minimum .. °Fahr.	75	10	78	82	(e)	(d)	(b) 10

(a) Government bores only. (b) Incomplete. (c) Total depth of all bores. (d) Flowing bores only. (e) Not available.

(ii) *Details for States.*—Considerations of space preclude the insertion of separate particulars of operations in the States during the year 1938-39. Details for earlier years will, however, be found in issues of the Official Year Book prior to No. 23, 1930

§ 2. Irrigation.

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 generally proved fairly successful, most of the States, instead of promoting new settlement in unoccupied regions, are adopting the policy of making existing settlements closer, by repurchasing large estates, sub-dividing them into holdings of suitable sizes for cultivation, and selling the land upon easy terms of payments. It is in connexion with this Closer Settlement policy that the special value of irrigation is recognized. Information regarding the various irrigation schemes in operation was given in some detail in preceding issues of the Official Year Book (see No. 23, pp. 637-61).

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

† *E. F. Pittman, A.R.S.M., formerly 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); "The Great Australian Artesian Basin," Sydney, 1914; and "The Composition and Porosity of the Intake Beds of the Great Australian Artesian Basin," Sydney, 1915.

2. **Areas Irrigated.**—The following table gives the areas irrigated in each State during the years 1928–29 to 1938–39. It should be noted that the area shown for New South Wales refers only to crops irrigated. It does not include pasture land and fallow land which may have been irrigated and consequently the area is not strictly comparable with that shown for those States which include these areas.

IRRIGATION: AREAS IRRIGATED.

Season.	N.S.W. (a)	Victoria.	Queensland.	S. Aust.	W. Aust.	Tasmania.	Total.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1928–29 ..	123,129	471,695	25,344	39,236	4,907	7,054	(b)671,475
1929–30 ..	126,321	566,577	26,282	40,002	4,943	6,693	770,818
1930–31 ..	135,121	463,098	26,947	43,538	5,661	6,488	680,853
1931–32 ..	114,777	418,415	28,414	42,813	6,104	7,768	618,291
1932–33 ..	130,977	474,716	31,409	42,556	6,434	7,605	693,697
1933–34 ..	131,772	435,324	29,363	42,898	7,640	9,194	656,191
1934–35 ..	125,423	494,226	34,138	39,594	8,861	7,786	(c)710,054
1935–36 ..	138,016	495,835	44,283	42,672	11,396	8,987	(c)741,312
1936–37 ..	151,683	518,827	44,509	42,292	13,295	9,987	(c)780,663
1937–38 ..	170,719	590,112	49,154	44,250	14,284	8,428	(c)876,953
1938–39 ..	183,518	515,357	48,953	43,602	14,278	8,599	(c)814,357

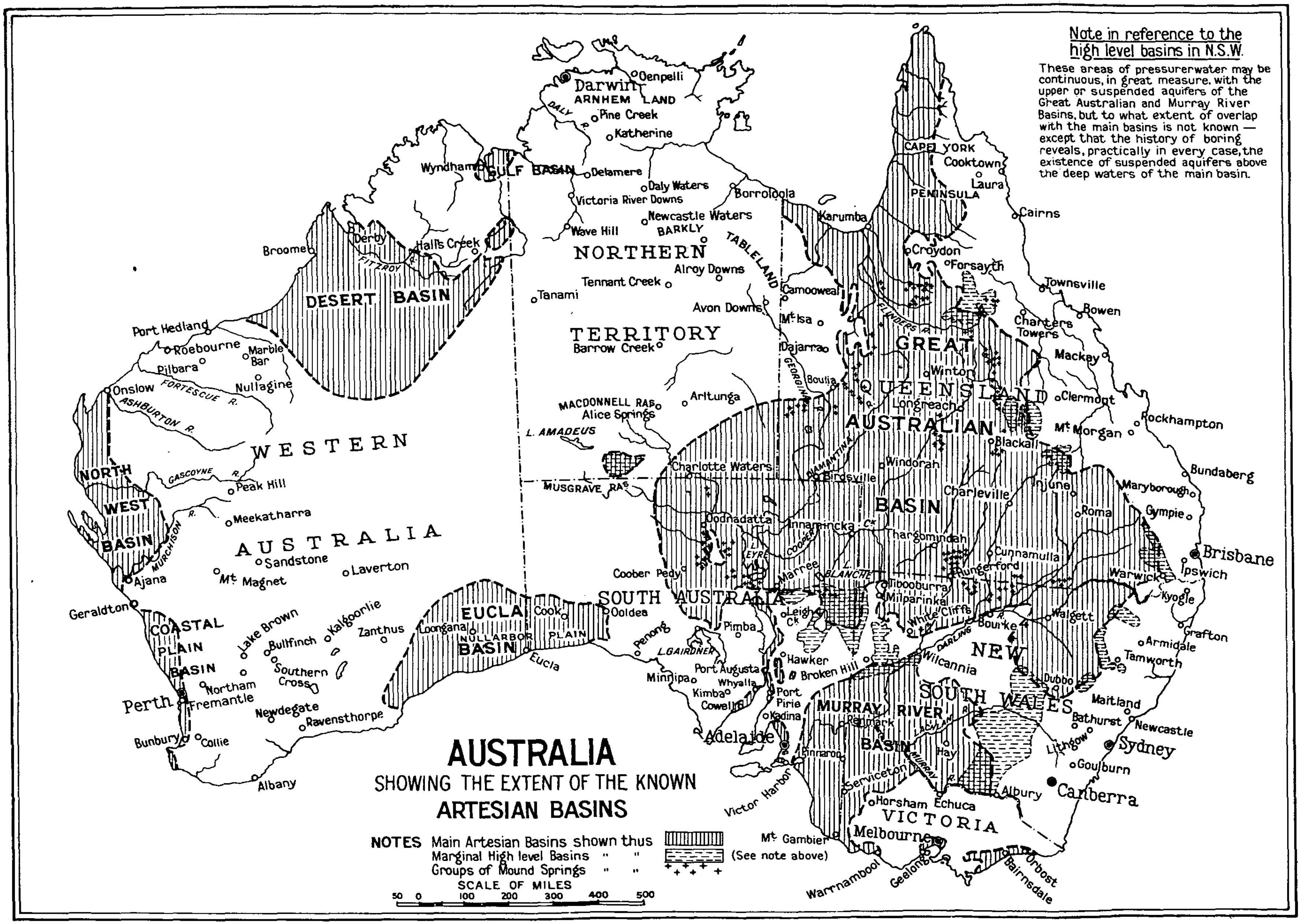
(a) Not including pasture and fallow lands. (b) Including 100 acres Northern Territory and 10 acres Australian Capital Territory. (c) Including Australian Capital Territory, 1934–35, 26 acres; 1935–36, 123 acres; 1936–37, 70 acres; 1937–38, 6 acres; 1938–39, 50 acres.

3. **Crops on Irrigated Areas.**—A classification of the crops grown on irrigated areas in each State during the year 1938–39, will be found in the table hereunder. Lucerne, grasses and green forage accounted for 29 per cent., cereals for 36 per cent., orchards and vineyards for 24 per cent., and root crops, market gardens, etc., for about 11 per cent. of the total area of crops under irrigation in 1938–39. It should be noted that the area in Victoria does not include 256,755 acres of pasture land and fallow land which were irrigated in 1938–39. Likewise 6,334 acres of pasture land are also omitted from the Tasmanian figures for the same year.

IRRIGATION: CROPS ON IRRIGATED AREAS, 1938–39.

Crop.	N.S.W.	Victoria.	Q'land.	S. Aust.	W. Aust.	Tas.	Total.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Cereals	114,842	84,379	380	..	..	..	199,601
Lucerne, Grasses and Green Forage ..	29,871	103,090	4,560	(a) 9,837	10,112	107	157,577
Orchards and Vineyards ..	28,902	65,137	7,071	28,662	2,322	637	132,731
Root Crops, Market Gardens and other Crops	9,903	5,996	(b) 36,942	5,103	1,844	(c) 1,521	(d) 61,359
Total ..	183,518	258,602	48,953	43,602	14,278	2,265	(d)551,268

(a) Including pasture land. (b) Including Sugar-cane, 35,515 acres; Cotton, 243 acres; and Tobacco, 1,095 acres. (c) Including Hops, 951 acres. (d) Includes 50 acres Australian Capital Territory.


AUSTRALIA
SHOWING THE EXTENT OF THE KNOWN
ARTESIAN BASINS
Note in reference to the high level basins in N.S.W.
These areas of pressurewater may be continuous, in great measure, with the upper or suspended aquifers of the Great Australian and Murray River Basins, but to what extent of overlap with the main basins is not known — except that the history of boring reveals, practically in every case, the existence of suspended aquifers above the deep waters of the main basin.
NOTES Main Artesian Basins shown thus
Marginal High level Basins " "
(See note above)
Groups of Mound Springs " "
SCALE OF MILES
50 0 100 200 300 400 500
GREAT AUSTRALIAN BASIN
MURRAY RIVER BASIN
DESERT BASIN
NORTH WEST BASIN
COASTAL PLAIN BASIN
EUCLA BASIN
GULF BASIN
NULLARBOR PLAIN
WESTERN AUSTRALIA
NORTHERN TERRITORY
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
ARNHEM LAND
CAPE YORK PENINSULA
BARKLY TABLELAND
MACDONNELL RAS
MUSGRAVE RAS
L. AMADEUS
L. EYRE
L. GAIRDNER
L. BLANCHE
Darwin
Oenpelli
Pine Creek
Katherine
Wyndham
Delamere
Daly Waters
Victoria River Downs
Borroloola
Newcastle Waters
Wave Hill
Halls Creek
Derby
Broome
Tennant Creek
Alroy Downs
Tanami
Avon Downs
Barrow Creek
Alice Springs
Arltunga
Charlotte Waters
Port Hedland
Roebourne
Marble Bar
Pilbara
Nullagine
Onslow
Peak Hill
Meekatharra
Sandstone
Mt Magnet
Laverton
Ajana
Geraldton
Lake Brown
Kalgoorlie
Zanthus
Bullfinch
Southern Cross
Northam
Perth
Fremantle
Newdegate
Ravensthorpe
Bunbury
Collie
Albany
Loongana
Cook
Ooldea
Eucla
Coober Pedy
Oodnadatta
Penong
Minnipa
Kimba
Cowell
Whyalla
Port Augusta
Pimba
Hawker
Leigh Ck
Marree
Port Pirie
Kadina
Adelaide
Victor Harbor
Pinnaroo
Renmark
Mt Gambier
Warrnambool
Geelong
Melbourne
Horsham
Echuca
Serviceton
Albury
Hay
Bairnsdale
Orbost
Canberra
Goulburn
Sydney
Lithgow
Bathurst
Newcastle
Maitland
Dubbo
Tamworth
Armidale
Grafton
Walgett
Bourke
Wilcannia
Broken Hill
White Cliffs
Milparinka
Tibooburra
Hungerford
Cunnamulla
Thargomindah
Innamincka
Birdsville
Windorah
Charleville
Roma
Injune
Warwick
Kyogle
Ipswich
Brisbane
Gympie
Maryborough
Bundaberg
Rockhampton
Mt Morgan
Blackall
Clermont
Longreach
Winton
Boulia
Dajarra
Mt Isa
Camooweal
Karumba
Croydon
Forsayth
Cooktown
Laura
Cairns
Townsville
Charters Towers
Bowen
Mackay