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FURTHER INVESTIGATIONS OF THE SOILS OF THE HARVEY AND WAROONA AREAS, W.A.

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FURTHER INVESTIGATIONS OF THE SOILS OF THE HARVEY AND WAROONA AREAS, WESTERN AUSTRALIA

by

W.M. McArthur

1. INTRODUCTION

The Western Australian Department of Public Works, in conjunction with the Department of Agriculture, is attempting to expand the areas of irrigated land, and the areas immediately bordering the present Irrigation Districts are the first to be considered. In many cases the soils in the fringing areas are similar to those already being irrigated and so their response to irrigation is known. In addition to this extension of the supply channels to adjacent areas presents no great engineering problem.

One such area under consideration is the strip of fine-textured soils on the Harvey and Wellesley River Flats and the purpose of this investigation was to examine these soils, delineate them accurately and, if possible, make an assessment of the irrigation potential of the major types.

The area is a long narrow strip of country stretching from the southern end of Harvey Estuary to the southern end of Benger Swamp, a distance of 30 miles. It adjoins the Pinjarra-Waroona survey (McArthur and Bettenay, in Press) to the north and the Collie Irrigation District survey to the south (McArthur and Bettenay 1957). In addition there is a strip of detailed survey running east-west at Harvey (Pym and Poutsma 1957) and the data from this map have been included for the sake of completeness. The survey is covered by Lands Department sheets 380/80, 383/80 and 411/80. The accompanying soil map shows clearly that the soils in question occur at the junction between the alluvial soils and the dune systems (Bettenay and McArthur, in press).

2. TOPOGRAPHY

The area under consideration is characterised by extremely low gradients, usually less than two feet to the mile. The natural drainage system is completely inadequate and drains have been excavated to take away the excess water. Even these are sometimes inadequate and the flats are flooded during prolonged periods of heavy rain. In the northern part of the area the water drains into the Harvey River while to the south it enters the Wellesley River and finally flows to the sea at Bunbury. The divide in the system, which is north-west of Harvey, is 53 feet above datum.

3. THE SOILS

For the purposes of this work the soil classification has been simplified. This is because many of the soils are composed of superimposed layers of different physical character and separation into the various combinations is not warranted. The system used is intended to group soils which will have similar major characteristics under irrigation. In the Harvey area Pym and Poutsma (loc. cit.) have divided the fine textured flats into four named series - Wellesley, Mangerstein, Eckersley and Benger, - and one un-named series in addition to unclassified swamps and clay pans. In this wor the Benger series has been retained as described. All soils having dense grey clay throughout the profile have been mapped as Wellesley clay and this includes those areas mapped as Mangerstein clay by Pym and Poutsma (loc. cit) The remainder of the area has been mapped as the Eckersley series, a polygenetic soil consisting of unrelated layers of material. In addition to the characteristics as described by Pym and Poutsma (loc. cit.) this soil is often underlain by a siliceous pan. All soils mentioned have been mapped and described in previous publications. Descriptions together with chemical and physical properties can be obtained from the references given in table 1.

4. RECOMMENDATIONS FOR LAND USE

(1) Boyanup series. This soil is a yellow podzolic having a sandy loam to clay-loam surface over a yellow-brown friable sub-soil. It has been amply described in the literature quoted and in the area under discussion is typical of the series. The Boyanup series is already irrigated successfully and can be expected to give good results here also. In fact it is the best irrigation soil in the area. The surface is typically gilgaied and so grading is necessary before irrigation.

(2) Coolup series. This is a meadow podzolic soil with a sharp textural break between the A and B horizons. At present there are no large areas of this type under irrigation and so the response cannot be confidently predicted. However experimental work both at Coolup and Boyanup should provide the required information. Indications are that care may be needed in watering these soils. The Coolup series is of minor importance in this area and the occurrences could safely be included in an irrigation area.

(3) Oakley series. This is a monotypic series having a sandy surface and a deep (36") sandy clay sub-soil. It occurs on slight rises and only in small areas. It is not recommended as an irrigation soil but because of its good drainage is a valuable asset for winter grazing and shelter when other soils are flooded.

(4) Gavin series. This is a very deep soil often with as much as 15 feet of sand overlying an organic B horizon. For this reason and because

TABLE 1

Location of published Soil type Descriptions and Laboratory Data

Unit	Reference
Benger Wellesley Eckersley Mangerstein Boyanup Joel	Pym, L.W. and Poutsma, T. 1957. Soils of the Harvey area, Western Australia. Soils and Land Use series No. 20.
Oakley Turkey Flat Complex 1 Complex 2 Complex 3 Boyanup Coolup Gavin	McArthur, W.M., Bettanay, E. and Hingston, F.J. (in press). Soils and Irrigation Potential of the Pinjarra-Waroona Area, Western Australia. Soils and Land Use Series No. Hingston, F.J. 1957. Laboratory Examination of Soils from the Pinjarra-Waroona Area, Western Australia. C.S.I.R.O. Div. Rep. 6/57 McArthur and Bettenay 1957. Soils of the proposed Extension to the Collie Irrigation District, Western Australia. C.S.I.R.O. Div. Rep. 7/57.

of its very low fertility, this soil is non-irrigable. In fact if this soil is cleared it requires careful management to prevent wind erosion. It is useful however, by virtue of its good drainage, for stock yards and buildings such as dairies and fodder sheds. Included also in this series are the parallel ridges and swales along the edge of Harvey Estuary. Much of this area is included in a flora and fauna reserve and cannot be considered for development.

(5) Joel series. This soil occurs as the low lying areas bordering the Gavin sand dunes and in the intervening valleys. The surface varies from sand to loam and with a coffee rock B horizon usually within 36" of the surface. The organic matter content of the surface is considerable by Western Australian standards, but the reaction is often low enough to affect availability of some plant nutrients and the salinity factor can be serious in some instances. With drainage the salt and pH problems of these soils can be expected to diminish and the natural fertility associated with the organic matter can be utilised. Because of the associated unproductive Gavin sand this series should not be included in an irrigation scheme.

(6) Turkey Flat series. This soil consists of about one to two feet of grey clay overlying a siliceous hard-pan. The soil was first described from the Pinjarra-Waroona area where it occurred fairly extensively. In this area it is of minor importance and probably should not be included in an irrigation area. It is stressed that the combination of tight clay and completely impervious hard pan makes this a very poor irrigation soil. In addition salts are often dangerously high. Where these soils occur in an irrigation area one or two waterings for early germination of Yarloop subterranean clover may be warranted.

(7) Complex 1. The soils of this area are variable but have in common a calcareous sub-soil and consequent high reaction. Included in the complex are the soils of the swales between the lunettes to the west of Benger Swamp and some small limestone mounds which are thought to be caused by evaporation of lime-rich waters from springs. The limestone outcrops in only a few spots but the influence of the lime is widespread. It is probably that irrigation of these soils is not warranted because irrigable areas in the complex are mainly narrow elongated strips between the lunettes. The soils are quite productive under dry-land culture due probably to the favourable water relations.

(8) Lunettes. The lunettes consist of grey brown sand at the surface changing to bright yellow brown and yellow sand at depth. They are very narrow and vary from 10 to 30 feet in height. Their main value lies in rough grazing and shelter during the winter and as sites for farm buildings and stock yards.

(9) Complex 2.- This area is the southern extension of the complex as defined in the Pinjarra-Waroona area. It consists of variable depths of sand overlying a calcareous clay sub-soil with the clay occasionally coming right to the surface. These soils occur to the west of the Gavin sand dunes and as such are not considered for inclusion in an irrigation area. Much of this country is at present uncleared but in those areas which have been developed there are indications that the soils are quite productive. One important point is that strawberry clover has shown promise and if this is proven other perennial species with some salt tolerance may be introduced with success. Some parts of the complex have a fairly high salt content and this may limit development.

(10) Complex 3.- This area consists of variable sandy and fine textured soils overlying an iron pan at shallow depth. At present it is uncleared and probably should remain so.

(11) Wellesley series.- This is the major component of the belt of fine-textured soils and extends, with minor variations, from the Harvey Estuary southwards to Benger Swamp.

The soil has a clay texture at the surface and changes but little with depth. There are however changes in colour down the profile, mottlings occurring below about 18 inches. Calcium carbonate, both powdery and nodular, and sometimes gypsum, occur sporadically but in general the soils in the southern part are more calcareous than in the north. The surface often has strong development of gilgais. The dominant characteristic of these soils is their fine texture. They are intensely cracked during the summer months and flooded, at least temporarily, in the winter.

These soils occur on very flat topography and from this point of view would present no engineering problems for irrigation. However there are several disadvantages which, at present, would exclude them from an irrigation area. Foremost of these is the fact that under the present drainage system these soils are flooded or at least waterlogged for about five months of the year and this represents a big loss in production. In early and late winter stock could be grazed on these areas but the surface soil is so plastic that much damage to pasture would result. Secondly, it is expected that because of the high clay content (50-70 per cent.) penetration of water may be very slow after the initial wetting. Finally their salt content and fertility status are such that development is probably not warranted. With improved drainage to give production during the winter months extension of the irrigation area to include these soils may be warranted but under existing conditions the area is probably best utilised for Yarloop subterranean clover with one or two waterings in the late summer to give longer growing conditions.

(12) Eckersley series.- This series comprises four types - sand, sandy loam, clay loam and clay-overlying a thin horizon of sand and then stiff clay. In addition, some areas have a siliceous hard pan within 36 inches of the surface. The soils are polygenetic, consisting of unrelated layers built up to make a pseudo-profile. However the characters are fairly uniform and the series can be considered as one unit for irrigation rating. The most important point about these soils is the presence of the completely impervious siliceous pan below the clay sub-soil. With no internal drainage salinity problems would be expected under irrigation practice. Where such soils are included in an irrigation area they could be watered for early germination of Yarloop clover. There is one small area which is sufficiently different to be separated. This area, denoted Un-named A series occurs in an embayment in the dune system. It is also a polygenetic profile having a variable amount of sand blown over a clay basement. It differs from the Eckersley series in that the clay horizon is highly organic. Under dry-land culture this soil is quite productive and its inclusion in an irrigation area is not warranted.

(13) Benger series.- This is the highly organic soil occurring on Benger Swamp. At present this area is used for intensive culture during the summer and is flooded during the winter to reduce weeds. It is probable that this is the only scheme which can take advantage of these fertile soils.

5. SUMMARY OF RECOMMENDATIONS

(1) The soils immediately adjacent to the present Harvey and Waroona Irrigation Districts - notably the Boyanup series with Coolup series as a minor component - are good irrigation soils.

(2) The soils of the Harvey and Wellesley River flats - Wellesley and Eckersley series - should not at present be included in an Irrigation District but with better drainage to allow utilisation during the winter their inclusion may be warranted.

(3) Any soils within or west of the Gavin sand dunes should not be considered for inclusion in a comprehensive irrigation scheme because of the expense of taking channels through unproductive country.

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