CHAPTER 10

CONCLUSION

10.1 Introduction

Two of the solutions promoted to satisfy the irrigation needs faced by a growing world population are the creation of new irrigation schemes and improving the efficiency of existing schemes. Observations of existing schemes both from first hand experience and through the literature have shown that the efficiency of irrigation systems is significantly reduced by aquatic weed growth in irrigation channels, drainage channels and in intermediate reservoirs. These guidelines develop an approach to dealing with this problem in a cost efficient way such that the efficiency of the scheme is overall improved, a contribution towards satisfying the irrigation needs of today and for tomorrow.

10.2 Aquatic weeds and their control

The impact of weed growth in channels is both direct, impeding water flow and hindering agricultural activity, and indirect, e.g. creating a habitat for the hosts of disease carrying snails and flies. The solution promoted here begins with developing an understanding of the aquatic weeds occurring in the channels. Identification of the offending species leads on to consideration of the most appropriate techniques for dealing with them. These guidelines have focused on manual control methods as the most widely used means of clearing weeds from channels.

There is a surprisingly wide range of tools which have been employed to cut, hoe and dig weeds although for any one scheme the range of tools being used is typically restricted to one or two techniques based very much on the tradition of that area. It is recommended that irrigation managers and farmers consider the wider range of tools and their applicability to the weed problems they encounter. Adding new tools to their armoury might not only improve weed clearing efficiency but also prevent laborers having to enter the water. This would reduce the likelihood of contracting water borne diseases.

Mechanical methods such as weed cutting buckets and weed boats might appear attractive but, apart from the initial cost, can pose problems in their maintenance and possibly more importantly the difficulty in making sure that they are well used throughout the cropping year. For this reason equipment which can be fitted onto existing tractors or excavators becomes more attractive from the economic viewpoint. Herbicides, too, have their limitations especially given the multiple use to which irrigation channels are put, e.g. drinking water and bathing. On the other hand, relative to mechanical methods, they can be cheap and particularly effective against certain types or species of weeds. Staff would need to be thoroughly trained in the use of chemicals for weed control in water, even those who are competent at using herbicides in the fields.

Biological control can be useful especially in the form of shading using trees or large leaved rooted floating species. These are best used as long term measures or built into new irrigation schemes in order to be of real value. Other biological agents such as herbivorous fish and insects are difficult to introduce at the scheme level but national

projects could be of significant value for certain target species such as water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*).

Environmental or integrated control can be valuable as an approach to aquatic weed control. It is unlikely that just one method of weed control will suffice for all the different types of weeds and channels and it is not a good idea to be reliant on a single approach. In reality, it is common to come across, for example, schemes managed using manual methods backed up by an excavator. More attention could be paid to the relationship between the methods of control and the success achieved in controlling the aquatic weeds. In effect, aquatic weed control is more to do with manipulating the ecology of the channel than specifically killing a particular type of weed or weeds. Cutting the weeds in a channel returns its ecology to an earlier stage in its development cycle, a development process which began after the last maintenance operation (Figures 3.2 and 3.3). dredging, for example, will return the ecology to the earliest stage in the cycle, whereas cutting will may be only push it back one stage.

Different channel types have different aquatic weed communities and these are one more reason for the need for different maintenance for different channel types. For example, primary irrigation channels need regular maintenance to keep them open and functioning efficiently. This creates a habitat suitable for submerged weeds which need to be cut by long handled scythes. A tertiary channel, however, is less critical in terms of function which, coupled with its smaller dimension means that it is suitable for emergent weed growth best managed using a slasher or hoe.

10.3 Relating weed growth to channel performance

In order to achieve efficient weed control, it is necessary to decide upon the level of service expected for each channel type. This level of service will tolerate a certain amount of weed growth depending upon channel type, but beyond that level of growth, the channel becomes inefficient and hence needs management. Irrigation managers and farmers should decide upon levels of service described both in engineering terms, e.g. freeboard, and weed terms, e.g. percentage weed cover of the channel which is acceptable for a given type of weed, such as 40% submerged weed and 10-20% emergent weed. The time at which assessments are made is important and should be related to the cropping cycle in that some channels will have a limited or no function at certain times of the year.

The level of service is not related to weed growth alone, and sediment accumulation is another important factor. This and other factors would need to be taken into consideration and the management might need to deal with silt accumulation and weed growth on some occasions whilst on others weed control alone might suffice.

10.4 Considering options

The guidelines promote an economic approach to determining the best option for weed management. This is based on describing the current modus operandi for the irrigation system and its associated costs extrapolated over a number of years. This exercise alone can be useful in determining where money is being spent and more importantly ways of working more efficiently, e.g. wiser use of labour. Current practice should then be compared with other management strategy options which have been drawn up for the scheme. These might be variations on the current regime or they might introduce new methods of manual control or include the purchase of a machine for mechanical control. Such options need to be costed out carefully and

again compared with current management over a number of years. The time factor is very important and a period of about 15 years is recommended.

The evaluation of management strategy options is initially time consuming as there is much data to collect on such factors as length of time it takes to maintain a stretch of tertiary channel and the annual maintenance costs for a mechanical excavator. After the first time, however, most of the data will remain much the same and the process becomes easier and quicker. Considering new options and monitoring the progress of implemented options becomes part of the overall system management.

The examples presented in these guidelines emphasise the need to deal with the economic factors in appropriate detail, e.g. including the need to write off capital purchases over time and the depreciation of assets.

10.5 Policy implications for planners and decision makers

The management of an irrigation system is governed in large measure by institutional factors. These need to foster the approach described in these guidelines, namely the acquisition of information relating to current weed maintenance and consideration of alternatives. On the basis of the outcome of such decision making, the institution needs to be able to implement those decisions and to appraise there success or otherwise over time.

The general existence of tight budgets strengthens the requirement for a systematic approach to maintenance. This requires an understanding of the necessary condition of assets to deliver a particular standard of performance and the identification of inputs and associated costs to meet that standard. Above all, maintenance should be viewed as a long term planned activity.

A strong and direct link between payment and service provision is likely to improve payment compliance and collection, And also farmer cooperation in maintenance programmes. These factors improve the prospects for cost recovery and a more hydraulically efficient and productive system.

There is a need to train staff at the scheme level to describe weed communities using the descriptive system referred to in Chapter 3, and to recognise the main species of plants, and then to plan weed management on the basis of species and ecology rather than tradition and expediency.

Projects for new and rehabilitated irrigation schemes provide opportunities to establish systematic maintenance procedures which integrate engineering, economic and ecological perspectives, as developed in this research. These procedures should prevent the establishment of undesirable species within the channels. The possible need for access of maintenance machinery also needs to be considered when designing the channels.

APPENDIX 1

Table A1.1 - Aquatic Weeds Recorded in Irrigation and Drainage Systems in Africa.

Scientific Name and Authority	Common Name	Habit
Abutilon guineense (Schumach.) Bak. & Exell		E
Acmella caulorhiza Delile		
Ageratum conyzoides		
Ajuga remota		
Alternanthera sessilis (L.) DC	Alternanthera	E
Alysicarpus rugosus		
Amaranthus hybridus L.	Smooth pigweed	E
Amaranthus spinosa		
***Ammania coccinea* Rottb.**	**Water amaranth**	E
Aponogeton abyssinicus		
Asystasia		
Azolla Lam.	Water-velvet	FF
***Azolla caroliniana* Willdenow**	**Mosquito fern**	FF
***Azolla pinnata* R.Br**	**Fairy moss**	FF
Basilicum polystachyon (L.) Moench.	Wild basil	
Bidens biternata		
Bidens pilosa		
Bothriochloa insculptum		
***Brachiaria mutica* (Forsk.) Stapf**	**Para grass**	E/RF
Centella asiatica		
Ceratophyllum demersum L.	Coontail	S
***Chara* L.**	**Stonewort**	A
***Chara contraria* A. Braun ex Kutz.**	**Stonewort**	A
***Chara globularis* Thuill.**	**Stonewort**	A
Chloris pycnothrix		
Commelina	Day flower	E
Commelina diffusa		
Conyza albida		
Corchorus asplenifolius		
Corchorus olitorius	Jew's mallow; jute	
Corchorus trilocularis		
Cynodon dactylon (L.) Pers.	Bermuda grass; couch; quick grass; star grass	E
Cyperus articulatus	Chintul	E
Cyperus difformis L.	Rice sedge	E
Cyperus digitatus Roxb. ssp. *auricomus* Spreng.		
Cyperus distans L.f.		
Cyperus dives		
Cyperus esculentus		
Cyperus involucratus		
Cyperus longus		
Cyperus papyrus L.	Papyrus	E
Cyperus rotundus	Nut grass	E
Datura stramonium		
Desmodium		
Dichanthium		
Digitaria		
Dinebra retroflexa (Vahl) Panzer	Cat's tail grass	
Dyschoriste		
Echinocloa L.	Wild millet	E

Echinochloa colona (L.) Link	Barnyard grass; jungle rice grass	
***Echinocloa crus-galli* (L.) Beauv.**	**Barnyard grass**	**E**
Echinocloa haploclada	**Wild millet**	**E**
Echinochloa jubata Stapf		
Echinochloa pyramidalis		
Echinocloa stagnina Retz. Beauv.	Watergrass	E
Eclipta alba (L.) Hassk.		
Eichhornia azurea (Sw.) Kunth.	Rooted water hyacinth	RF
Eichhornia crassipes (Mart.) Solms.	Water hyacinth	FF
***Elatine triandra* Schkruhr**	**Waterwort**	**S/E**
***Eleocharis* R.Br.**	**Spike rush**	**S/E**
***Eleocharis dulcis* (Burm. f) Henschel**	**Spike rush**	**E**
***Eleocharis palustris* (L.) Roemer & Schultes**	**Common spike rush**	**S/E**
Eragrostis N.M. Wolf	Lovegrass	
Eriochloa Kunth		
Erythrochlamys spectabilis		
Euphorbia heterophylla L.		
Euphorbia hirta L.	Asthma weed	
Euphorbia indica		
Euphorbia inequilatera		
Euphorbia serpens Kunth		
Fimbristylis bisumbellata		E
Fimbristylis dichotoma		
Fimbristylis ferruginea		
***Fimbristylis miliacea* (L.) Vahl.**	**Fringe rush**	**E**
Fluchea bequertii		
Galinsoga parviflora		
Hemarthria altissima		
***Heteranthera limosa* (Schwartz.) Willd.**	**Longleaf mudplantain**	**E**
***Heteranthera reniformis* Ruiz & Pavon**	**Round leaf mudplantain**	**E/RF**
Heteranthera rotundifolia	**Mud plantain**	
Indigofera parviflora		
Ipomoea aquatica (Forsk.)	Water spinach	RF
Ipomoea cairica		
Isachne	Isachne	E
Ischaemum afrum		
Kyllinga		
Launaea cornuta		
***Leersia oryzoides* (L.) Swartz.**	**Rice cut-grass**	**E**
Leersia hexandra		
Lemna L.	Duckweed	FF
Lemna gibba L.	Fat duckweed	FF
Lemna minor L. agg	Lesser duckweed	FF
***Lemna perpusilla* Torr.**	**Duckweed**	**FF**
Lindernia dubia	**False pimpernel**	**E**
Ludwigia L.	False loosestrife	RF
Ludwigia abyssinica		
Ludwigia decurrens Walt.	Water primrose	
Ludwigia jussiaeoides		
Ludwigia octovalvis		
Ludwigia repens Forst	Water primrose	S/E/FF
Ludwigia stolonifera (Guill. & Perr.) Raven	Creeping water primrose	
***Ludwigia uruguayensis* (Cambess.) Hara**	**Water primrose**	**E**
Lythrum rotundifolium		
Marsilea		
Mimulus gracilis R. Br		
Monochoria elata	Monochoria	E
***Monochoria korsakowii* Regal & Maack**	**Monochoria**	**E**
***Myriophyllum aquaticum* (Vell.) Verd.**	**Parrotfeather**	**S/E**
***Myriophyllum brasiliense* Cambess.**		

Myriophyllum spicatum L.	Spiked water milfoil	S
Myriophyllum exalbescens Fern.		
***Myriophyllum verticillatum* L.**	**Whorled water-milfoil**	**S**
Najas horrida A. Braun ex Magnus	Niaid	S
***Najas guadalupensis* (Spreng.) Magnus**	**Southern naiad**	**S**
Najas marina L.	Holly-leaved niaid	S
***Najas minor* All.**	**Brittle naiad**	**S**
Nesaea Commers.		
Nidorella resedifolia		
***Nitella* (C.A. Agardh.) Leonhardi**	**Stonewort**	**A**
***Nuphar lutea* L. Sm.**	**Yellow waterlily**	**RF**
***Nuphar luteum* Sibth. & Small**	**Spatterdock**	**RF**
***Nymphaea* L.**	**Water lily**	**RF**
***Nymphaea alba* L.**	**White waterlily**	**RF**
***Nymphaea coerulea* Savigny**	**Water lily**	**RF**
***Nymphaea lotus* L., non Hook. f. & Thoms.**	**Water lily**	**RF**
***Nymphaea odorata* Ait.**	**Fragrant water lily**	**RF**
***Nymphoides indica* (L.) O. Kuntze**	**Water snowflake**	**RF**
***Nymphoides peltata* (S.G. Gmel.) O. Kuntze**	**Fringed waterlily**	**RF**
Ottelia alismoides (L.) Pers.	Turtle grass	S
Ottelia exerta		
Oxalis		
Oxygonum sinuatum		
Panicum repens L.	Torpedo grass	E
***Paspalum distichum* L.**	**Knotgrass**	**E**
Paspalum pasploides		
Paspalum scrobiculatum L.	Creeping paspalum; kodo millet	
Persicaria decipiens (R. Br.) K.L. Wilson		
Persicaria senegalensis (Meisn.) Sojak		
Phragmites australis (Cav.) Trin. ex Steudal	Common reed	E
Phragmites communis Trin.		
Phyllanthus maderaspatensis		
Pistia stratiotes L.	Water lettuce	FF
Polygonum amphibium L.	Amphibious bistort	RF
Polygonum hydropiper (L.) Spach	Water-pepper	E
Polygonum persicaria L.	Redshank	E
Polygonum pulchrum		
Polygonum salicifolium		
Portulaca oleracea		
***Potamogeton amplifolius* Tuckerman**	**Large-leaved pondweed**	**S**
Potamogeton crispus L.	Curled pondweed	S
***Potamogeton foliosus* Raf.**	**Leafy pondweed**	**S**
***Potamogeton gramineus* L.**	**Various-leaved pondweed**	**S**
***Potamogeton illinoensis* Morong**	**Illinois pondweed**	**S**
Potamogeton nodosus Poir.	Loddon pondweed	S/RF
Potamogeton pectinatus L.	Sago pondweed	S
Potamogeton perfoliatus L.	Perfoliate pondweed	S
***Potamogeton praelongus* Wulfen**	**Long-stalked pondweed**	**S**
***Potamogeton pusillus* L.**	**Lesser pondweed**	**S**
***Potamogeton richardsonii* (Benn.) Rydb.**	**Clasping-leaved pondweed**	**S**
***Potamogeton tricarinatus* F. Muell. & A. Benn, ex A. Benn**	**Floating pondweed**	**S/RF**
Potamogeton trichoides Cham. & Schlecht.	Hair-like pondweed	S
Pycnostachys deflexifolia		
Pycreus polystachyos		
Rhynchosia holstii		
Rottboellia cochinchinensis (Lour.) W.D. Clayton	Guinea-fowl grass; itch grass	
Salvinia Seguier	Salvinia	FF
***Salvinia cucullata* Roxb.**	**Water spangle**	**FF**
Salvinia molesta D.S. Mitchell	Kariba weed	FF
Schoenoplectus		

Scirpus L.	Bulrush	E
Sesbania		
Setaria		
Sida cuneifolia		
Sida rhombifolia		
Solanum incanum		
Solanum nigrum		
Sonchus		
Sorghum arundinaceum		
Sphaeranthus cyanthuloides		
Sporobolus		
Stenotaphrum secundatum (Walt.)	Buffalo grass	
Typha L.	Cattail	E
Typha angustata Bory & Chaub.	Cattail	E
Typha angustifolia L.	Narrowleaf cattail	E
Typha domingensis Pers.	Southern cattail	E
Typha latifolia L.	Common cattail	E
***Vallisneria americana* Michx.**	**Eelgrass**	**S**
***Vallisneria spiralis* L.**	**Ribbon-weed**	**S**
Vernonia glabra		
Vigna oblongifolia		
Vossia cuspidata (Roxb.) Griff.	Hippo grass	E
Zannichellia palustris L.	Horned pondweed	S

A = alga; E = emergent; FF = free-floating; FL = floating-leaves; S = submerged.

Table A1.2 Noxious weeds in irrigation and drainage channels in Africa.

Scientific Name and Authority	Common Name	Status
Azolla Lam.	Water-velvet	
Cyperus papyrus L.	Papyrus	N
Echinochloa sp.	Wild millet	N
Eichhornia crassipes (Mart.) Solms.	Water hyacinth	E
Leersia hexandra		N
Panicum repens L.	Torpedo grass	N
Pistia stratiotes L.	Water lettuce	N
Salvinia molesta D.S. Mitchell	Kariba weed	N
Typha domingensis Pers.	Southern cattail	N
Vossia cuspidata (Roxb.) Griff.	Hippo grass	N

E = exotic species; N = native species.

Table A1.3 Uses for aquatic weeds occurring in irrigation and drainage systems in Africa.

Species	Uses
Acmella caulorhiza	Kenya: crushed plant is applied to broken limbs. West Africa: used for medicinal purposes.
Ageratum conyzoides	Kenya: juice is used to stop bleeding, to treat sore eyes and bowel complaints. West Africa: used for medicinal purposes.
Ajuga remota	Kenya: used as a cure for malaria.
Alternanthera sessilis	Kenya: used a soil addititve; leaves are used as famine food and as fodder during drought periods.
Amaranthus hybridus	Asia and America: occasionally grown as a grain crop. Zimbabwe: leaves are used as spinach; whole plant is sometimes burnt and the ash mixed with snuff or used in place of salt when cooking other leaves.
Bidens biternata	Zimbabwe: young shoots and leaves are cooked as a relish; plant is used for medicinal purposes.
Bidens pilosa	Kenya: used as a cure for diarrhoea in suckling babies.
Commelina sp.	Kenya: leaves are used as a vegetable; plant also used as a fodder and as a soil additive.
Corchorus asplenifolius	Zimbabwe: leaves are cooked as a relish.
Corchorus olitorius	Asia: plant is grown commercially for fibre. Kenya and Zimbabwe: leaves are cooked as a relish; stem is used as fibre.
Cynodon dactylon	Zimbabwe: used for lawns and sportsfields, bank stabilisation and waterway protection; also provides good grazing.
Cyperus digitatus	Zimbabwe: stems are used for weaving mats and baskets and also as a thatching material.
Cyperus dives	Kenya: leaves are used as a thatching material, as fodder and as a soil additive.
Cyperus esculentus	Kenya: dried tubers are used as ornamental beads. Southern and central Europe: plant is grown commercially for the edible tubers (tiger nuts). Zimbabwe: new tubers are chewed raw or cooked as vegetables; after roasting and grinding they may be used as a coffee substitute; plant is a source of potash for softening and flavouring green leaves.
Cyperus involucratus	Zimbabwe: root is prepared for potash; stems are used for weaving mats.
Cyperus latifolius	Kenya: leaves are used as a hatching material, as fodder and as a soil additive; plant is a source of potash for softening and flavouring green leaves.
Cyperus rotundus	China: the plant is used in traditional medicine. Kenya: dried tubers are used as ornamental beads.
Echinochloa colona	Zimbabwe: seeds are sometimes collected and ground into flour.
Euphorbia heterophylla	East Africa and Malaya: plant is used in traditional medicine.

Euphorbia hirta	Britain, India and West Africa: plant is used for medicinal purposes.
Imperata cylindrica	Kenya: plant is used as a thatching material.
Lantana camara	Kenya: ashes from burned leaves and salt are used to treat coughs, sore throats conjunctivitis and toothache.
Leersia hexandra	Kenya: leaves and sand are used for cleaning calabashes; plant is also used as fodder and as a soil additive.
Ludwigia stolonifera	Kenya: plant is used as a soil additive.
Paspalum scrobiculatum	India: improved strains are cultivated for grain and fodder as Kodo millet.
Phragmites mauritiana	Kenya: plant is used in house construction.
Portulaca oleracea	Europe: young shoots are eaten as a salad vegetable. Zimbabwe: plant is sometimes cooked as a relish. Plant is, or was, used as a pot-herb and a medicinal herb in many countries.
Ricinus communis	Kenya: stems are used for firewood. Castor oil, extracted from plant, is used in many countries.
Rottboellia cochinchinensis	Zimbabwe: grain is used as famine food.
Schoenoplectus sp.	Kenya: plant is used as fodder and as a soil additive.
Solanum incanum	Kenya: juice from the roots is used as a remedy for abdominal pains.
Solanum nigrum	Kenya: leaves are used as a vegetable and ground into a powder for treatment of burns and scolds. Zimbabwe: black, mature fruits are used in jam-making; leaves are cooked as relish; plant is used for medicinal purposes.
Sonchus oleraceus	Europe: young shoots are sometimes used in salads. Kenya: plant is used as rabbit food. Malawi and Zimbabwe: leaves are occasionally cooked as a vegetable.
Typha latifolia	Kenya: used for ornamental purposes, as bedding material and as fodder. Zimbabwe: all parts of plant may be used differently as famine food; plant may be burnt and used for salt substitute.

Table A2.1 **PRESENT VALUE OF £1**

Years Hence	4%	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%	26%	28%	30%	35%	40%
1	0.962	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833	0.820	0.806	0.800	0.794	0.781	0.769	0.741	0.714
2	0.925	0.907	0.890	0.857	0.826	0.797	0.769	0.756	0.743	0.718	0.694	0.672	0.650	0.640	0.630	0.610	0.592	0.549	0.510
3	0.889	0.864	0.840	0.794	0.751	0.712	0.675	0.658	0.641	0.609	0.579	0.551	0.524	0.512	0.500	0.477	0.455	0.406	0.364
4	0.855	0.823	0.792	0.735	0.683	0.636	0.592	0.572	0.552	0.516	0.482	0.451	0.423	0.410	0.397	0.373	0.350	0.301	0.260
5	0.822	0.784	0.747	0.681	0.621	0.567	0.519	0.497	0.476	0.437	0.402	0.370	0.341	0.328	0.315	0.291	0.269	0.223	0.186
6	0.790	0.746	0.705	0.630	0.564	0.507	0.456	0.432	0.410	0.370	0.335	0.303	0.275	0.262	0.250	0.227	0.207	0.165	0.133
7	0.760	0.711	0.665	0.583	0.513	0.452	0.400	0.376	0.354	0.314	0.279	0.249	0.222	0.210	0.198	0.178	0.159	0.122	0.095
8	0.731	0.677	0.627	0.540	0.467	0.404	0.351	0.327	0.305	0.266	0.233	0.204	0.179	0.168	0.157	0.139	0.123	0.091	0.068
9	0.703	0.645	0.592	0.500	0.424	0.361	0.308	0.284	0.263	0.225	0.194	0.167	0.144	0.134	0.125	0.108	0.094	0.067	0.048
10	0.676	0.614	0.558	0.463	0.386	0.322	0.270	0.247	0.227	0.191	0.162	0.137	0.116	0.107	0.099	0.085	0.073	0.050	0.035
11	0.650	0.585	0.527	0.429	0.350	0.287	0.237	0.215	0.195	0.162	0.135	0.112	0.094	0.086	0.079	0.066	0.056	0.037	0.025
12	0.625	0.557	0.497	0.397	0.319	0.257	0.208	0.187	0.168	0.137	0.112	0.092	0.076	0.069	0.062	0.052	0.043	0.027	0.018
13	0.601	0.530	0.469	0.368	0.290	0.229	0.182	0.163	0.145	0.116	0.093	0.075	0.061	0.055	0.050	0.040	0.033	0.020	0.013
14	0.577	0.505	0.442	0.340	0.263	0.205	0.160	0.141	0.125	0.099	0.078	0.062	0.049	0.044	0.039	0.032	0.025	0.015	0.009
15	0.555	0.481	0.417	0.315	0.239	0.183	0.140	0.123	0.108	0.084	0.065	0.051	0.040	0.035	0.031	0.025	0.020	0.011	0.006
16	0.534	0.458	0.394	0.292	0.218	0.163	0.123	0.107	0.093	0.071	0.054	0.042	0.032	0.028	0.025	0.019	0.015	0.008	0.005
17	0.513	0.436	0.371	0.270	0.198	0.146	0.108	0.093	0.080	0.060	0.045	0.034	0.026	0.023	0.020	0.015	0.012	0.006	0.003
18	0.494	0.416	0.350	0.250	0.180	0.130	0.095	0.081	0.069	0.051	0.038	0.028	0.021	0.018	0.016	0.012	0.009	0.005	0.002
19	0.475	0.396	0.331	0.232	0.164	0.116	0.083	0.070	0.060	0.043	0.031	0.023	0.017	0.014	0.012	0.009	0.007	0.003	0.002
20	0.456	0.377	0.312	0.215	0.149	0.104	0.073	0.061	0.051	0.037	0.026	0.019	0.014	0.012	0.010	0.007	0.005	0.002	0.001
21	0.439	0.359	0.294	0.199	0.135	0.093	0.064	0.053	0.044	0.031	0.022	0.015	0.011	0.009	0.008	0.006	0.004	0.002	0.001
22	0.422	0.342	0.278	0.184	0.123	0.083	0.056	0.046	0.038	0.026	0.018	0.013	0.009	0.007	0.006	0.004	0.003	0.001	0.001
23	0.406	0.326	0.262	0.170	0.112	0.074	0.049	0.040	0.033	0.022	0.015	0.010	0.007	0.006	0.005	0.003	0.002	0.001	-
24	0.390	0.310	0.247	0.158	0.102	0.066	0.043	0.035	0.028	0.019	0.013	0.008	0.006	0.005	0.004	0.003	0.002	0.001	-
25	0.375	0.295	0.233	0.146	0.092	0.059	0.038	0.030	0.024	0.016	0.010	0.007	0.005	0.004	0.003	0.002	0.001	0.001	-
26	0.361	0.281	0.220	0.135	0.084	0.053	0.033	0.026	0.021	0.014	0.009	0.006	0.004	0.003	0.002	0.002	0.001	-	-
27	0.347	0.268	0.207	0.125	0.076	0.047	0.029	0.023	0.018	0.011	0.007	0.005	0.003	0.002	0.002	0.001	0.001	-	-
28	0.333	0.255	0.196	0.116	0.069	0.042	0.026	0.020	0.016	0.010	0.006	0.004	0.002	0.002	0.002	0.001	0.001	-	-
29	0.321	0.243	0.185	0.107	0.063	0.037	0.022	0.017	0.014	0.008	0.005	0.003	0.002	0.002	0.001	0.001	0.001	-	-
30	0.308	0.231	0.174	0.099	0.057	0.033	0.020	0.015	0.012	0.007	0.004	0.003	0.002	0.001	0.001	0.001	-	-	-
35	0.253	0.181	0.130	0.068	0.036	0.019	0.010	0.008	0.006	0.003	0.002	0.001	0.001	-	-	-	-	-	-
40	0.208	0.142	0.097	0.046	0.022	0.011	0.005	0.004	0.003	0.001	0.001	-	-	-	-	-	-	-	-
45	0.171	0.111	0.073	0.031	0.014	0.006	0.003	0.002	0.001	0.001	-	-	-	-	-	-	-	-	-
50	0.141	0.087	0.054	0.021	0.009	0.003	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	-

Table A2.2 **CAPITAL RECOVERY FACTORS**
(PERIODIC PAYMENT UNDER AN ANNUITY OF N PAYMENTS, PRESENT VALUE OF WHICH IS £1, ONE PERIOD BEFORE THE FIRST PAYMENT)

N	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%	30%	N
1	1.050	1.060	1.080	1.100	1.120	1.140	1.150	1.160	1.180	1.200	1.220	1.240	1.250	1.300	1
2	0.538	0.545	0.561	0.576	0.592	0.607	0.615	0.623	0.639	0.655	0.670	0.686	0.694	0.735	2
3	0.367	0.374	0.388	0.402	0.416	0.431	0.438	0.445	0.460	0.475	0.490	0.505	0.512	0.551	3
4	0.282	0.289	0.302	0.315	0.329	0.343	0.350	0.357	0.372	0.386	0.401	0.416	0.423	0.462	4
5	0.231	0.237	0.250	0.264	0.277	0.291	0.298	0.305	0.320	0.334	0.349	0.364	0.372	0.411	5
6	0.197	0.203	0.216	0.230	0.243	0.257	0.264	0.271	0.286	0.301	0.316	0.331	0.339	0.378	6
7	0.173	0.179	0.192	0.205	0.219	0.233	0.240	0.248	0.262	0.277	0.293	0.308	0.316	0.357	7
8	0.155	0.161	0.174	0.187	0.201	0.216	0.223	0.230	0.245	0.261	0.276	0.292	0.300	0.342	8
9	0.141	0.147	0.160	0.174	0.188	0.202	0.210	0.217	0.232	0.248	0.264	0.280	0.289	0.331	9
10	0.130	0.136	0.149	0.163	0.177	0.192	0.199	0.207	0.223	0.239	0.255	0.272	0.280	0.323	10
11	0.120	0.127	0.140	0.154	0.168	0.183	0.191	0.199	0.215	0.231	0.248	0.265	0.273	0.318	11
12	0.113	0.119	0.133	0.147	0.161	0.177	0.184	0.192	0.209	0.225	0.242	0.260	0.268	0.313	12
13	0.106	0.113	0.127	0.141	0.156	0.171	0.179	0.187	0.204	0.221	0.238	0.256	0.265	0.310	13
14	0.101	0.108	0.121	0.136	0.151	0.167	0.175	0.183	0.200	0.217	0.234	0.252	0.262	0.308	14
15	0.096	0.103	0.117	0.131	0.147	0.163	0.171	0.179	0.196	0.214	0.232	0.250	0.259	0.306	15
16	0.092	0.099	0.113	0.128	0.143	0.160	0.168	0.176	0.194	0.211	0.230	0.248	0.257	0.305	16
17	0.089	0.095	0.110	0.125	0.140	0.157	0.165	0.174	0.191	0.209	0.228	0.246	0.256	0.304	17
18	0.086	0.092	0.107	0.122	0.138	0.155	0.163	0.172	0.190	0.208	0.226	0.245	0.255	0.303	18
19	0.083	0.090	0.104	0.120	0.136	0.153	0.161	0.170	0.188	0.206	0.225	0.244	0.254	0.302	19
20	0.080	0.087	0.102	0.117	0.134	0.151	0.160	0.169	0.187	0.205	0.224	0.243	0.253	0.302	20
21	0.078	0.085	0.100	0.116	0.132	0.150	0.158	0.167	0.186	0.204	0.223	0.243	0.252	0.301	21
22	0.076	0.083	0.098	0.114	0.131	0.148	0.157	0.166	0.185	0.204	0.223	0.242	0.252	0.301	22
23	0.074	0.081	0.096	0.113	0.130	0.147	0.156	0.165	0.184	0.203	0.222	0.242	0.251	0.301	23
24	0.072	0.080	0.095	0.111	0.128	0.146	0.155	0.165	0.183	0.203	0.222	0.241	0.251	0.301	24
25	0.071	0.078	0.094	0.110	0.127	0.145	0.155	0.164	0.183	0.202	0.222	0.241	0.251	0.300	25
26	0.070	0.077	0.093	0.109	0.127	0.145	0.154	0.163	0.182	0.202	0.221	0.241	0.251	0.300	26
27	0.068	0.076	0.091	0.108	0.126	0.144	0.154	0.163	0.182	0.201	0.221	0.241	0.251	0.300	27
28	0.067	0.075	0.090	0.107	0.125	0.144	0.153	0.163	0.182	0.201	0.221	0.241	0.250	0.300	28
29	0.066	0.074	0.090	0.107	0.125	0.143	0.153	0.162	0.181	0.201	0.221	0.240	0.250	0.300	29
30	0.065	0.073	0.089	0.106	0.124	0.143	0.152	0.162	0.181	0.201	0.221	0.240	0.250	0.300	30