

THE RUDIMENTS OF HYDRAULIC ENGINEERING

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649545919

The Rudiments of Hydraulic Engineering by G. R. Burnell

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Cover @ 2017

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OF
HYDRAULIC ENGINEERING,

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WITH ILLUSTRATIONS.

PART I.

LONDON :
JOHN WEALE, 59, HIGH HOLBORN.
1858.

186. c. 8.

LONDON:
BRADFORD AND EVANS, PRINTERS, WHITEFRIARS.



PREFACE.

HYDRAULIC ENGINEERING.

IN the first edition of the "Rudimentary Treatise on Civil Engineering," the plan upon which the whole subject was treated had been drawn up on such principles as to render necessary, in a manner, the discussion of many questions connected with the science of Hydraulic Engineering in the general body of the work. It would, perhaps, be difficult to define exactly the limit of demarcation between the duties of the civil and of the hydraulic engineer, if indeed any distinction between the two professions be recognised; so that even in reproducing the portion of the Treatise especially devoted to the latter division of the subject, in a separate form, much of the original confusion must still exist. An attempt has, however, been made to bring together in the following pages the consideration of the bulk of the subjects especially connected with building in water, or with the applications of that fluid; and, to some extent, to make this Rudimentary Treatise, as far as possible, complete in itself. But it must be observed that, firstly, the discussion of such subjects as those of bridge building would involve a

repetition of a large portion of the work already so well performed by Mr. Law; and, secondly, that the enquiry into the best methods of improving rivers, or of establishing canals, or into the laws of the resistance and movement of fluids, would lead to such an extension of this Treatise, as to render it advisable to depart, in some cases, even from this more recent programme. It is for these reasons, therefore, that the reader is still referred to Mr. Law's "Rudiments of Civil Engineering" for the technical details connected with bridge building; and that Mr. Weale has requested me to devote separate Treatises to some of the other branches of hydraulic engineering whose importance appeared to warrant the distinction; but, nevertheless, it has been my object to render the whole work as uniform and complete, and as free from repetitions, as possible.

It is far from being my intention to claim any merit on the score of the originality of the following pages. Indeed it is more than questionable, whether the author of a Rudimentary Treatise be entitled, under any circumstances, to venture upon the insertion, in such works, of opinions, or of doctrines, which are susceptible of dispute. It is his province to record the universally received theories on the subjects he treats, and he is thus debarred from the expression of opinions which may hereafter be proved to be incorrect. With such convictions then, I have carefully avoided the introduction of controverted doctrines, and have unhesitatingly resorted to the common fund of scientific *knowledge to be found in the writings of the most*

esteemed authors. Wherever it has been possible the names of those authors have been quoted; but no doubt many involuntary omissions have been made in this respect. The names of the authors consulted in the preparation of this work are, therefore, added in a special Appendix; and the more importance is to be attached to this list, inasmuch as it will (it is hoped) serve to guide the student in his future reading. There is great truth in the maxim, "Scire ubi aliquid invenire possis, maxima pars scientiæ est;" and it may be that the insertion of the Bibliography of Hydraulic Engineering would enable the reader to supply the deficiencies of this work itself. It happens that the majority of the best books on subjects connected with hydraulics generally are written in foreign languages; and perhaps it may be to this fact, that we owe the singular ignorance of educated Englishmen upon the subject. A series of translations, like Mr. Bennett's able translation of d'Aubuisson's *Hydraulique*, would be of great value, and might induce even our legislators to pause before they meddled with subjects they are apparently so little able to comprehend. In the meantime a mere list of these authors will be of use.

That, in fact, our legislators are often misled in these matters, must be evident to any one who recalls the history of the "Sanitary Movement," as it is called, within the last few years. It would be difficult to say how this unfortunate tendency is to be effectually combated; but, at any rate, it is the duty even of the *writer of a Rudimentary Treatise*, to call attention to

the most flagrant of the mistaken theories which prevail in high, or authoritative, quarters. In the sections of the following little work devoted to the consideration of town sewerage, and town water supply, an attempt has therefore been made to divert public attention from the incorrect doctrines lately promulgated "by authority" on such subjects, and to direct that attention to the writings of the men who really knew something of the laws (both natural and municipal) which affect those branches of hydraulic engineering. Of course it would be impossible to exhaust such investigations in a merely preliminary treatise; and for this reason again, it has become important to place before the public such indications of the best sources of information, as may enable it to complete what may herein be deficient. The necessity which unfortunately exists for attacking some of the doctrines recently propounded by the very branches of administration which profess to "guide public opinion," may, however, give to some portions of the following work somewhat of a controversial nature. This is much to be regretted; and, as far as possible, I have sought to avoid such discussions, and have only introduced them when it appeared to be absolutely necessary so to do, in order to resist the diffusion of mischievous error. Singularly enough one of the members of a recent ministry was actively concerned in the promulgation, in a neighbouring country, of some of the absurd nonsense with respect to these subjects of sewerage and water supply which has cost us so very dear. It behoves all engineers, then, to record their protest against the

theories and practices so recommended, and to save others, if possible, from the bitter disappointment which they would infallibly encounter if they followed such blind guides. Besides this cosmopolitan motive for alluding to the errors of our rulers, it is now, more than ever, important to induce the public to revert to sound doctrines on many points connected with the application of the physical sciences; for the evil consequences of the mistaken principles lately applied to town sewerage especially, are beginning to produce fearful results. The state of the Thames and of many of our great rivers, indeed, is such as to inspire well-founded apprehension, and also, I fondly hope, an earnest desire on the part of the public to hear any conscientious opinion as to the measures requisite, either for the prevention, or for the remedy of evils so imminent, and so enormous.

In this edition of the Rudiments of Hydraulic Engineering, an attempt has been made to embody our present knowledge of the Chemistry of Building materials with the other portions of the theory of that branch of the profession. This section is, in fact, little else than a condensation of a paper read by myself at the Institute of British Architects, and of an article on Atmospheric influence inserted in the "Dictionary of technical terms," published by the Architectural Publications Society. It is avowedly incomplete; because hitherto very little attention has been devoted to the subject, and there is little satisfactory knowledge thereon to be discovered in the best treatises on Engineering. The insertion of this