Water Resources Finance

Martin Doyle, martin.doyle@duke.edu;

PURPOSE: This course is intended to provide students with applications of project finance to water assets, including municipal water/wastewater systems, irrigation infrastructure, and emerging types of ecosystem related assets. The primary concepts will be on revenue-generation, rate structures, pricing effects, debt financing (municipal bonds), equity financing, public-private partnerships, and emerging alternative finance including impact investing and conservation finance. The course will focus on US water contexts and applications, and it will not focus on public equities and associated markets.

Format:
The course format will be a combination of traditional lectures with homework sets to be done primarily using MS-Excel.

Assignments and Grades:
Course evaluation will be based on 4 assignments, each done largely during class time, with final write ups done between courses. Assignments will be done in groups. Your final grade will be based on an equal weighting of these assignments. The assignments will be quantitative analyses but will be in the form of technical memos as the final product for evaluation.

Readings:
We will be using a wide array of readings from different sources, some from engineering textbooks, some from finance resources. We will also be drawing on consulting and planning reports from different cities to draw lessons. Readings will be provided and assigned, but will not be specifically evaluated for grades.

Quantitative Analysis:
This course will have a quantitative analysis/modeling component to it, but using well established techniques and industry standard approaches. We will use some probability and statistics, but most math will be intuitive and easily done using spreadsheets. Students are expected to be proficient with XL.

General Resources on Finance and Water Resources:
NOTE: this is a topic that receives little traditional academic or classroom attention. As such, there are few textbooks that cover how utilities are managed, how water is priced, and how water infrastructure is financed. There are a few general resources that are good to have:

Raftelis, Water and Wastewater Finance and Pricing, CRC Press.

Hyman et al., The Water Business: Understanding the Water Supply and Wastewater Industry, Public Utility Reports, Inc., Vienna, VA.

American Water Works Association Manual of Water Supply Practices (note: there is a series of these manuals that cover different topics, e.g., M50: Water Resources Planning).

Environmental Finance Center: this is a research center at UNC that is top rate in taking on issues related to water pricing and finance. Their report series is irreplaceable.

In addition to these readings, I have a few go-to resources for finance; my favorite is a free online book
Welch, I., Corporate Finance: An Introduction, Prentice Hall.

Opening reading:
Leurig, S., 2012. Water Ripples: Expanding risks for US water providers. Ceres.

1. Intro to Finance

- Water resources and water utilities
- Why we pay for water
- Mega-trends: Changing sources of capital (public to private), growing regulations, climate change, aging infrastructure
- NPV, Debt, and Equity

XL Resource: developed in class.

Readings:
Raftelis, G., Ch 4: Alternatives to Private Financing. Water and Wastewater Finance and Pricing. CRC Press.
S&P Ratings Services, Water: the Most valuable liquid asset? Special report, 2012.
[there are other readings on the site as well that are supplemental]

2. Bonds

- Debt vs equity
- Coupon, face value, and vanilla bonds
- Yield vs coupon
- Municipal bonds: what is in an offering?
- Durham's water bond

XL Resource: Durham 2011 for homework.xls (not for a homework; just xl title)

Readings:
Bond Key terms.pdf (general description on bonds)
City of Durham, Utility System Revenue and Revenue Refunding Bond Series, 2011

3. Water Pricing and Rate Structures

- Water and wastewater pricing process
- Determining the cost of service
- Designing a water rate structure
- Alternative rate structures for conservation and revenue stabilization

XL Resource: Sample billing data.xls

Readings:

Hughes and Leurig, Assessing Water System Revenue Risk: Considerations for Market Analysts. Ceres Report, 2013.

Tiger, M., and J. Hughes, 2012. An exploration of alternative business models for the Beufort-Jasper Water and Sewer Authority. UNC Environmental Finance Center.

Rafetlis chapters 10, 13, and 14.

4. Equities: Private Project Finance and (Briefly) Publically Traded Opportunities

- Water ETFs (very brief)
- Equity vs debt, equity and debt
- Sources of revenue stream
- Realistic IRRs from conservation projects
- Why is private finance a growing portion of water infrastructure finance?
- Where private investment meets conservation finance

XL Resource: Simple IRR FOR CLASS.xlsx

Readings:

Culp and Bayon, 2016. Liquid Assets: Investing for Impact in the Colorado River Basin. Walton Family Foundation.

5. Public-private partnerships (P3s) and Alternative Delivery Methods

- What is a P3?
- Why so much interest in P3s?
- When are P3s appropriate; when are they inappropriate?
- How can P3s be used for conservation finance?
- State Revolving Funds and Green Infrastructure
- Super-wonky tangent on why P3s aren't used by federal government

XL Resource: being developed

Readings:

Canadian Council for Public-Private Partnerships, 2011. Public-Private Partnerships: A guide for municipalities. PPP Canada.

Raftelis Ch 7: Overview of Delivery Methods.

6. Impact Investing

- Layered/stacked capital
- Environmental Impact Bonds: DC Water green infrastructure
- New roles for philanthropy?

Readings:

DC Water, DC Water's Green Bond Report, FY 2015.

DC Water Environmental Impact Bond Fact Sheet.

Patterson et al., 2017. Conservation finance and impact investing for US Water. Aspen Institute and Nicholas Institute Water Forum report.