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Visioning of Next-Generation Wastewater Resource Recovery Facilities: Summary Findings of Student Work

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1 ABSTRACT

Components of traditional industrial infrastructure systems have unilateral input-output relationships—individual components transfer energy from natural resources and then dissipate the byproducts as waste into the natural environment. In what has been termed “Infrastructural Ecology", a multilateral approach reveals interdependencies and potential reciprocities between several urban systems viewed as part of a whole. To the extent that City authorities undertake improvements and upgrades to major facilities such as wastewater treatment processes and their campuses, an intersectoral approach, based on progressive trends for next-generation facilities incorporating practices for resilience, is timely. [1,2]

This paper provides a review of experimental findings from a sustainability graduate class that analyzed the cross-cutting issues and opportunities explored on the campuses of seven of the fourteen existing Wastewater Treatment Facilities in New York City. The students’ findings and visions highlight the potential to break down municipal department silos and foster cross-sector collaboration to develop synergies that can decarbonize operations, metabolize portions of the City’s waste stream, incentivize further resource recovery, and provide important co-benefits to improve the resilience, livelihoods, and quality of life in the adjacent communities.

Keywords: Infrastructure Planning, Sustainable Communities, Green Infrastructure, Food-Water-Energy Nexus, Wastewater Treatment

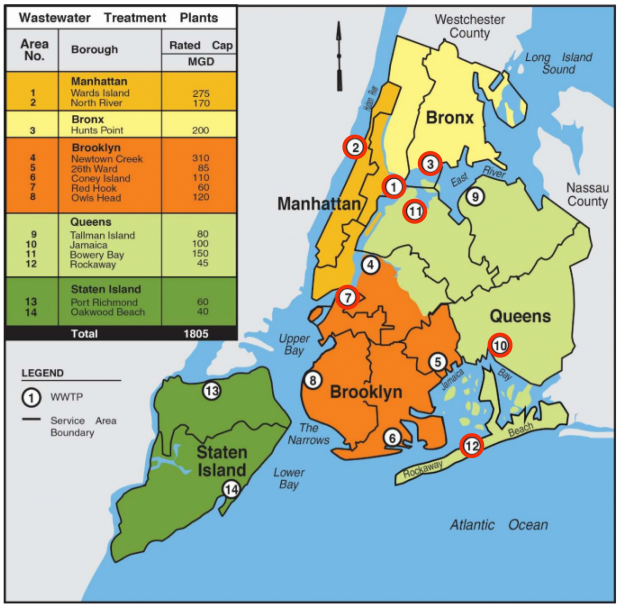

Fig. 1: NYC Wastewater Treatment Plants, selected sites with red circle.

2 STUDENT EXAMINATION OF WRRF SITES IN NYC

2.1 Introduction

New York City’s fourteen Wastewater Treatment Plants, recently re-titled to be known as Wastewater Resource Recovery Facilities (WRRFs), are distributed throughout the five boroughs. Collectively they treat 1.3 billion gallons of wastewater daily (NYC Open Data). All fourteen plants are adjacent to bodies of water, including the Hudson and East Rivers, Jamaica and Bowery Bays, making the plants and nearby sewerage systems vulnerable to climatic threats like increased flooding, more frequent and intense storm surge, increased saltwater intrusion, and coastal erosion. In addition to their vulnerabilities, current facilities have been traditionally subject to design practice that turns these large facilities into fenced-off, impenetrable

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campuses, cutting off their neighboring communities' access to the waterfront, denying them valuable open space and connection with nature. Considered locally unwanted land uses (LULUs), these facilities can cause burdensome traffic, noise, odors, and may contribute to adverse public health. [3]

2.2 Student Examination of Seven WRRF Sites

Student teams were challenged to apply a set of principles and concepts to their assigned site using both analytical skills and creative intuition. Their final models were to reflect site assemblies that fostered potential new synergies between urban infrastructures - wastewater treatment, organic waste management, energy generation, and transportation. Students identified other nearby infrastructure facilities, commercial and municipal services to create potential loop-closing arrangements. Following an assessment of community needs/aspirations, potential new programmatic elements—appropriate public and community-oriented uses—were proposed for incorporation into the WRRF and/or adjacent underutilized sites, along with the addition of climate-resilient features to protect the enhanced campus and, possibly, nearby neighborhood areas.

3 COMPARATIVE ANALYSIS OF THE SITES

3.1 Methodology

We highlight commonalities and differences in the students' work across the selected seven sites as developed using public datasets and tools, GIS-based mapping of neighborhood assets and features, annotated GoogleEarth views, community surveys. Site strategies are identified and illustrated based on these these existing condition findings and site features.

3.2 Using the ENVISION Framework

The "Envision Framework," began as a guide to sustainability in infrastructure planning and construction, developed by the Institute for Sustainable Infrastructure (ISI) at Harvard University, In this treatment we adopt categories of the Envision Framework and group student findings into them. This is is intended to not only validate the work of the students against this sustainability guidance standard but also to further promote the use of Envision and its comparative metrics in other City agency capital investments. [4,5]

3.3 Site Strategies

Individual summaries are presented of what the student groups envisioned for each of the seven identified sites. Charts include flow-schematics for process inter-dependencies, developing following an Industrial Ecology model (Figure 2). Key concepts and proposed improvements of the student teams are identified in annotated Google Earth images and 3-D representations (Figure 3).

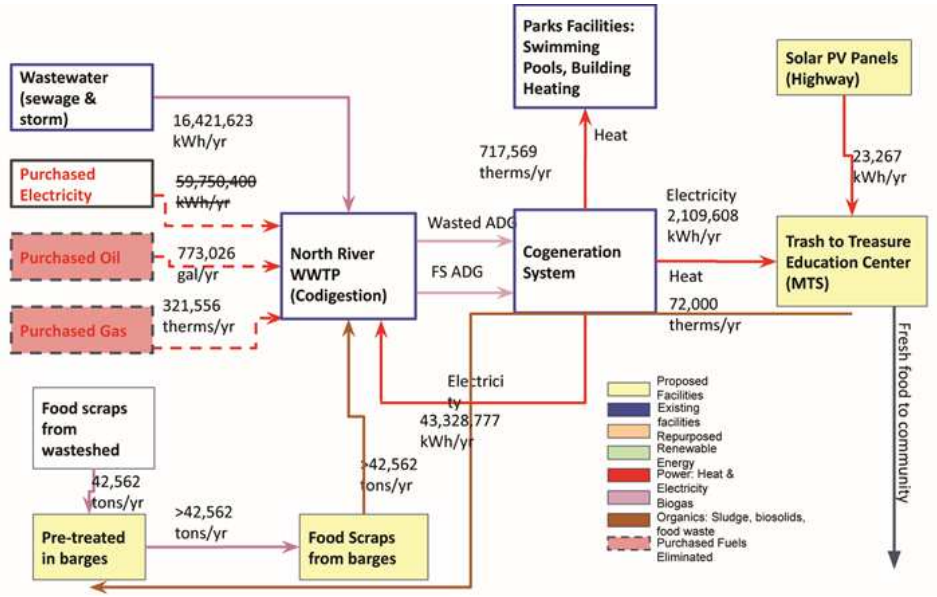

Fig. 2: North river water resource recovery facility, flow diagram. Source: student's work based on information provided by DEP.

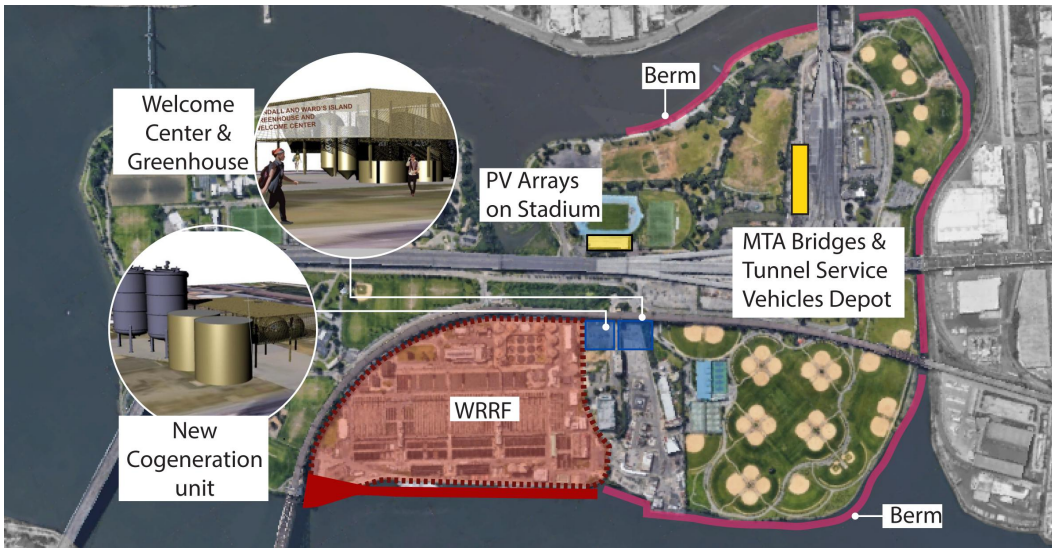

Fig. 3: Sample of student presentation of features as annotated GoogleEarth view

4 CONCLUSION

This exercise and summary report are an invitation to think and plan across the silos of City departments. This would allow for more extensive new connective waterfront greenways and open spaces, working with nature and with communities to improve overall quality of life. Such multilateral relationships described by the students' conceptual models for each of the seven WRRFs can serve to promote reciprocal exchanges of energy and matter on the path towards significant waste and GHG reductions, while also increasing the resiliency of each major component as well as the system as a whole. It is hoped that these principles and practices may eventually lend themselves to being widely adapted for a more "post-industrial" approach to infrastructure development not only by NYC DEP, but across all other city agencies.

5 REFERENCES

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