Aguas Claras: Colombia's Breakthrough in Wastewater Infrastructure

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Abstract

This case study explores how Medellín, Colombia's 2018 state-of-the-art Bello Wastewater Treatment Plant has revitalized both the river and its surrounding community. The Medellín River flows through Colombia's second-largest city, between Aburrá and Medellín. Since the early 20th century, it has experienced significant environmental challenges with sanitation, stemming from sewage, industrial discharge, and riverside settlements. By analyzing the history of wastewater treatment in Colombia and throughout South America, this case study provides insights into the complexities of managing urban water bodies and the importance of collaborative, sustainable approaches to ensure the health and vitality of industrial water systems.

Background

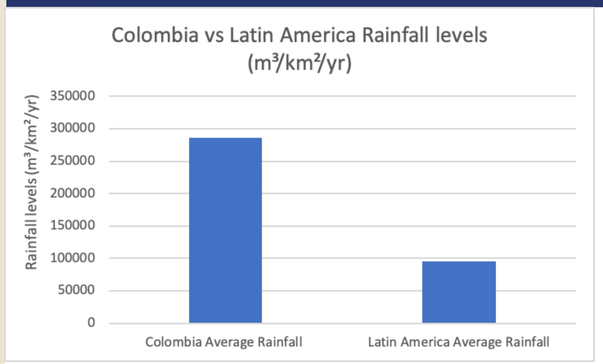

Figure 1 (Left): Colombia's average rainfall vs average Latin America rainfall per meter per year , leading to larger river flow that requires a treatment plant capable of handling excess amounts of organic matter (WaterWorld)

Figure 2 (Left): Photograph of the Bello Wastewater Treatment Plant, processing 84% of the Aburrá Valley's wastewater by filtering 140 tons of organic matter per day (Grupo EPM)

Figure 3 (Above): Photograph of the Medellín River flowing through Medellín, Colombia (Americas Quarterly)

Details & Data

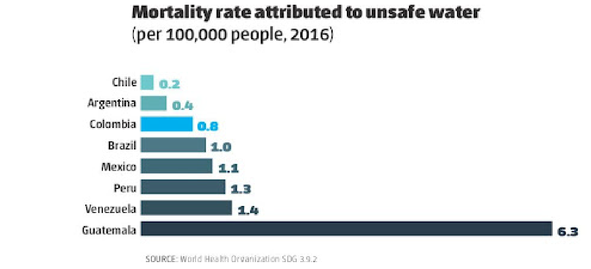

Figure 4 (Left) Colombia vs average Latin America mortality rate from unsafe water (WHO SDG)

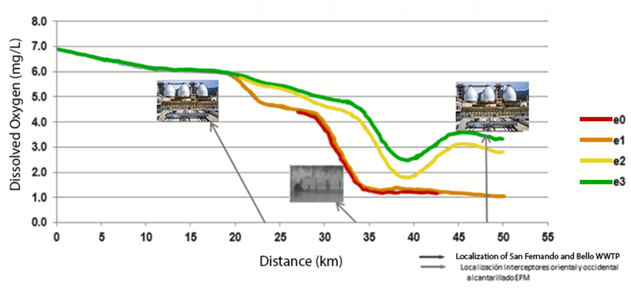

Figure 2 (Left) Oxygenation projections of Medellín River (e0 = now, e1= 2 years, e2= 5years, e3= 10 years)

Conclusion

The river that once was "colored red and blue" has taken a significant stride towards restoring the once prominent ecological balance.

Effectively establishing a metropolis like Medellín takes a collaborative effort from government agencies, public utilities like Empresas Publicas, and surrounding communitites.

Medellín serves as an example for other countries in Latin America that investing millions in public infrastucture can promote commerce and communal living, improving quality of life massively through a long standing wastewater treatment system.

Teaching the Case Study

Learning Objectives

Learn about the impact and importance of wastewater treatment and management, and how it can be achieved in a city with complex terrain like Medellín.

Pre-Class Assignment:

Read *Medellín's Other Success Story: How the City Cleaned Up Its Water*
Sign up as a country in Latin America and write a letter to public utilities regarding how wastewater treatment could be implemented in their city.

In-Class Assignment:

The Bogotá River in Colombia is incredibly polluted, similar to the previous state of the Medellín river. Students will use information from their readings and split into two public utility companies. Each will advocate for why they should be in charge of building the new Bogotá plant and discuss the various technologies to be implemented.

Stakeholders

Medellín Residents	Are directly affected by bacteria in the water, can benefit from communal activities along the river
Empresas Públicas de Medellin	Took $500M loan to build the plant, need to show drastic improvement in Medellín River to make returns on investment
Colombian government	Wants the river cleaned to further develop Medellín as an industrial capital of Latin America
Latin America	Can use Medellín's multimillion-dollar wastewater system as a blueprint for other countries looking to bolster their industrial infrastructure

Analysis and Discussion

- Projections for dissolved oxygen levels in the Medellín River in 10 years (e3) 50km downstream show drastically increased dissolved oxygen levels, showing potential for the revitalization of fisheries in the river should dissolved oxygen levels go above 5 mg/l.

- Countries like Mexico, Peru, and Venezuela can reduce their mortality rate due to unsafe water with the implementation of similar state-of-the-art wastewater treatment plants, which can also stimulate their economy due to the improvement of urban infrastructure.

References

EPM Clear Water Treatment Plant. Aguas Claras Parque Planta de Tratamiento de Aguas EPM. (n.d.). https://www.-grupo-epm.com/site/aguasnacionales/nuetros-proyec-tos/aguas-claras-planta-de-tratamiento/aguas-claras-planta-de-tratamiento

Giraldo-B, L. C., Palacio, C. A., Molina, R., & Agudelo, R. A. (2015, July 10). Water quality modeling of the Me-dellin River in the Aburrá Valley. DYNA. https://www.researchgate.net/publication/281592953_Water_qual-ity_modeling_of_the_Medellin_river_in_the_Aburra_Valley

Negarin, M. (2015, December 29). Colombia's Bello Breakthrough: Self Sufficient Wastewater treatment. Water-World. https://www.waterworld.com/wastewater/article/16201838/colom-bias-bello-breakthrough-self-sufficient-wastewater-treatment

Seth Kugel | October 11, 2019. (2021, October 13). Medellín's other success story: How the city cleaned up its water. Americas Quarterly. https://www.americasquarterly.org/article/medellins-oth-er-success-story-how-the-city-cleaned-up-its-water/

World Health Organization. (2016). SDG target 3.9 mortality from environmental pollution. World Health Organiza-tion. https://www.who.int/data/gho/data/themes/topics/sdg-target-3_9-mortality-from-environmental-pollution

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