

Was a TMDL for copper, ambient toxicity, temperature and sediment toxicity in Patrick Bayou necessary and what did we learn?

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A Total Maximum Daily Loading (TMDL) study for Patrick Bayou, segment 1006 of the Houston Ship Channel is in progress. Patrick Bayou is a 5km urban stream receiving permitted treated municipal and industrial wastewater from six dischargers. Based upon a 1994 study there was a 303d impairment listing for dissolved copper, ambient toxicity, sediment toxicity and temperature. The designated use for the bayou is only for navigation and industrial water supply, and not designated for the protection of aquatic life. Aquatic life protection was considered only as an afterthought for consideration of downstream waters of the Houston Ship Channel and Galveston Bay. An extensive one-year field program utilizing Texas TMDL guidance and a plan approved by the Texas regulatory involved a technical team, the lead organization of sponsoring permitted dischargers and a stakeholder panel. The technical assessment concludes that the bayou should not be listed for dissolved copper and water toxicity. Copper concentrations have not exceeded the new standard developed for the Houston Ship Channel using the water effect ratio (WER) approach. Chronic ambient toxicity was not observed and past occurrences were attributed to ionic imbalance in two effluents and ammonia related to municipal plant operations. All prior conditions have been changed with process changes and wastewater system upgrades. Analysis of the benthic community, sediment chemistry and sediment toxicity formed that basis for the "sediment triad". Sediment toxicity was inconsistent between species, station location and sampling period. Pore water extracted from whole sediment was not toxic to either species showing that the responsible sediment toxicants cannot be released into the water column. Benthic communities are driven by salinity and are similar to disturbed communities of similar structure and conditions in the Galveston Bay area. Sediment toxicity is not statistically related to the benthic population or sediment chemistry. Although sediment concentrations exceed some published screening benchmarks, not attribution can be made for identifying organics. The most advanced techniques for sediment toxicity identification evaluation (TIE) were applied without success to identify specific chemicals. The sediment toxicity narrative should not be applied because there is no translator mechanism to go from inappropriate benchmark screening levels and permit limits for those chemicals. Extensive dye studies and model simulations in the bayou demonstrated that the predominant cause of limited temperature elevation in summer conditions results from solar inputs rather than discharge thermal loading. Because the temperature standard is exceeded under natural conditions, a use attainability analysis is appropriate for this bayou. Clean Water Act section 316(a) for thermal discharges should be applied with provisions to demonstrate that a "balanced indigenous population" exists in the bayou. This raises issues concerning how to protect downstream uses correctly while not overburdening the stream with unrealistic requirements that conflict with designated uses that are less than aquatic use. Guidance is needed for 303(d) listing criteria and "exit ramps" along the assessment process when inconclusive conclusions lead to unclear solutions.