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Environmental Impact of Tombia Bridge Construction Across Nun River In Central Niger Delta, Nigeria

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ABSTRACT
An assessment of some aspects of the Environmental Impact of Tombia Bridge Construction across the Nun River was carried out. The construction phase of the Tombia bridge project was observed by this study to have the potential to increase erosion, turbidity, sediment deposition and accumulation levels around and downstream of the project site. The test results showed high turbidity values of 64 NTU in the Bridge Station and 8 – 18 NTU recorded at the downstream and upstream stations of the Bridge. Phosphate values of 0.12 – 0.14mg/l recorded at the Bridge stations were higher than the 0.06 – 0.09mg/l in the other stations. Nitrate values of 4.12 – 4.15mg/l recorded at the Bridge stations were also comparatively higher than 0.5mg/l in the other stations. These results were indicative of influence of Bridge construction on turbidity, phosphate and nitrate levels. Therefore, bridge construction activities within the channel of the Nun River have adverse effect on the water quality. The bridge construction activities also have the potential to cause a temporary increase in suspended sediments. Aquatic habitat will be disturbed in the vicinity of the construction area. Aquatic life uses of this portion of the Nun River will be negatively impacted. The bridge structure itself was observed during this study to cause a constant upwelling of sediments around the bridge location and is confirmed by very high turbidity values of 64NTU recorded in the area and downstream of the bridge location. The distribution of particle size fractions shows a high proportion of sand particles at the Bridge stations; indicative of higher energy environment. Sediments in the study area were generally acidic (ranging from 4.21 –5.61): acidic sediments can have an adverse effect on fisheries distribution and other benthic organisms. Available Phosphate values of 2.71 – 17.24mg/l and Nitrate values of 3.11 – 13.4mg/l recorded in this study were higher than those in other studies. Bridge construction activities within the cannel of the Nun River have adverse effect on the sediment quality.

KEYWORDS: *Environmental Impact, Tombia Bridge, Nun River, Central Niger Delta*

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I. INTRODUCTION

This study addresses potential short- and long-term water quality, sediment quality and biological impacts from the various activities associated with the Bridge construction. Sediments threaten the integrity of many rivers and coastlines. In this study the threat to Nun River ecosystems – biological communities and physical habitats – posed by increased turbidity, accelerated sedimentation rates and change in the nature of sediments (for example, from sandy to muddy) was investigated. Such changes in sediment regime may be caused by both land-based (such as catchments development, production-forest harvesting, road building) and water-based (bridge construction, eradication of noxious vegetation) activities.

Tombia Bridge is located along Amassoma – Tombia – Okutukutu road crossing the Nun River in Bayelsa State (Central Niger Delta). The length of the Bridge is 639.2m and the width is 11m. The foundation consists of driven groups of pile steel casings of 914mm and 812mm diameter in water and 406mm diameter on land. Pile caps were reinforced insitu concrete and the piers were also reinforced concrete, rectangular shaped with curved ends. The super structure is a Post – tensioned box girder of 13 spans.With a total length of 195km and average width of 370m, the Nun River is considered the largest in Bayelsa State (FPD, 1980). It flows through several communities in Bayelsa State, where it is used for domestic / drinking purposes, recreational, fishing and ecological assets. But, owing to rapidly expanding developmental activities within its channels, it is subject to the effects and influences of these developments.

II. MATERIALS AND METHODS

The research tools employed in this study includes the following:

[1] Water Quality Assessment (Physico-chemical & Biological Monitoring)
For the purposes of this study the area was divided into the stations. Water samples were collected from two (2) points on each of the stations. The samples for gross physico-chemical parameters were collected in pre-rinsed 1 litre plastic containers. The samples for dissolved oxygen (DO) and biochemical oxygen demand (BOD) were collected in 150m / DO bottles. The samples for BOD_5 were fixed after five days incubation at ambient temperature (28^oC) in the absence of light. Physico-chemical parameters analysed were Temperature, pH, Turbidity, Conductivity, DO, BOD_5, Total Dissolved Solids (TDS), Phosphate and Nitrate. All the samples were treated and analysed using the methods described by APHA (1990).

[2] Sediment Quality Assessment
Sediment samples were collected from three (3) points on each of the stations in the study area. Sediment samples were collected by scooping bottom sediments using a grab into black cellophane bags. The following sediment physico-chemical parameters were analysed in the laboratory; pH, Particle Size analysis, Phosphate and Nitrate. The samples were treated and analysed using methods described by APHA (1990).

[3] Symtomized Questionnaire Survey
Symptomised questionnaires were administered to 30 respondents from Tombia which is the community where the bridge is located. The purpose of this survey is to identify their perceptions; coping strategies during the bridge construction activities; and their willingness to participate in mitigation measures that will be aimed at reducing their level of vulnerability to possible environmental and ecological change.

[4] Semi-structured interviews with key informants which includes all stakes holders in the matter including independent environmental organisations,

[5] Observation and terrestrial photography at the sample community; and

[6] Desk study for the review of literature on bridge construction hazards, impacts, mitigation measures, approaches and stakeholders participation in sustainable impact mitigation.

III. RESULTS AND DISCUSSION

The results of the concentration of various parameters in river water and sediment samples are shown in Tables 1 and 2 respectively.

The following potential Environmental Impact observations were made during the course of this study:

[1] SEDIMENT DEPOSITION & ACCUMULATION

Deposition refers to the temporary emplacement of particles on the seabed. Accumulation is the net sum of many episodes of sediment deposition and removal. The difference between rates of deposition and accumulation affects the ability of an environment to record sedimentary events (McKee *et al*., 1983).The design of culvert and bridge systems is based on allowing the natural and storm flows to pass through the system, while also maintaining some minimum freeboard upstream. Sometimes, the design criteria force the culvert or bridge geometry to be wider than the natural width of the channel. In these cases, an artificial channel expansion is required. Artificial expansions disturb the natural flow of the channel, and these disturbances can lead to sediment deposition within the culvert or bridge system. Sediment deposition within a culvert or bridge system may cause significant problems to the hydraulic performance of the system in the event of a large storm event. In addition, the deposition also poses a maintenance problem that must be addressed.It was observed during this study that there was significant occurrence of sediment deposition and accumulation around the bridge location which is indicative of direct effect on fish spawning and production. Sediment transport and eventual deposition within culvert and bridge systems can be a significant problem. It has been well documented that increased sediment deposition can adversely change sediment habitat conditions.
Potential direct effects of sediment deposition and accumulation as a result of the Bridge construction on fish include changes to (Anderson, *et al*., 1996):

1. Fish behaviour (e.g. habitat selection),
2. the abundance and/or type of food organisms,
3. survival and, or development of egg; and,

4. fish survival as a result of mortality, or increased stress which can reduce their growth rates and/or resistance to disease;

In addition, sediment deposition and accumulation can modify the suitability of fish habitats. Identified mechanisms causing changes in sediment suitability include:

1. altered porosity in the streambed affecting the development of fish embryo and benthic invertebrate production;
2. reduction in he area of intergravel habitat for and juvenile fish; and benthic organisms,
3. reduction in available over wintering habitat for fish by filling of pools and interstitial voids.

[2] RIVER CURRENT DYNAMICS

Rivers are restless and willful. Water flowing in a smooth and uniform channel behaves in straightforward, predictable ways, following rules laid down by the laws of physics. When water and landscape meet to form rivers, however, the result is always a complex harmony—and sometimes chaos.Now when a river finds an obstruction—a mid-stream boulder, say, poking up above the surface. The river flows around it. The once-straight lines of the current spread apart, only to close together as soon as the obstruction has been left behind. Moreover, water now flows back upstream just behind the rock, striving to fill the "hole" in the river left by the temporary parting of the waters. If the river's current is slow, the result is a gentle eddy. But if the river is speeding along in flood, and particularly if the boulder is then completely submerged, the result is a "hole" in fact as well as name, often with a steep wave breaking upriver at the downstream edge (Tamia, 2001). Mid-stream boulders aren't the only things to get in the way of a river's rush to the sea, of course. Wherever a ledge extends out into the channel from one bank, the river must either cascade over it or go around the end. When it goes around, the whole force and volume of the river is squeezed through the remaining gap, whether large or small.

The river speeds up there, and the resulting tongue of water, or chute, can be both fast and turbulent. A pair of mid-river boulders can have the same effect, forcing much of a river's current through the narrow gap between them. The characteristic downstream-pointing "V" that identifies the resulting chute is one of the whitewater paddler's watermarks. And what if a ledge extends all the way across a river, reaching right from one bank to the other? Then it has the same effect as a man-made dam. As the pool behind the dam continuously overflows, a river-wide upstream eddy—a *r*eversal—forms below the ledge. If a reversal is powerful enough—the drop would not be very great if the volume of water flowing over it is sufficient, and the lip of the ledge is smooth—it can be deadly, holding any unlucky swimmer in a recirculating trap with no exit but a fluctuating downstream jet at the very bottom of the river (Tamia, 2001). The description above confirms the observations in this study. The Tombia Bridge is suspended by massive boulders that have been driven into the streambed, these are current breakers. This study revealed water turbulence around the bridge location.The implication of this is that there is a continuous upwelling in the area, and as a result, there is a continuous resuspension of sediment in the area (Reid and Anderson, 1998). The result of this phenomenon is that the Nun River is highly turbid around this area, which confirms the very high turbidity values recorded in this study i.e. 64NTU. A further confirmation is the colour of the river around this area.

[3] DREDGING AND CONSTRUCTION ACTIVITY

During dredging, resuspension of sediment in the water column is likely to occur as a result of dredging action at the sediment-water interface, transfer of the sediment to a transporting vessel, slop or leakage from the vessel, and disposal of the sediment. Resuspension of the sediments causes increased turbidity which may adversely affect aquatic life by clogging gills, decreasing visibility, and preventing oxygen diffusion. However, since the increased turbidity is expected to be short term and only cover a limited area, the impact should not be significant (Richard, *et al*., 1997). Resuspension of sediments may result in release of constituents such as heavy metals from the sediment into the water. Therefore, water quality parameters, such as turbidity, heavy metals, and nutrients could be affected during the dredging operations. However, studies have found that there is little release of metals from reduced sediments in oxygenated water during dredging operations. Water concentrations of some metals have been shown to decrease by four orders of magnitude within one hour of dredging, with metals released from anoxic marine sediments tending to adsorb onto freshly precipitated iron/manganese oxyhydroxides in less than an hour (Burton and Allen, 1992). Any increase in the above parameters is likely to be short term, and the water quality is expected to return to normal levels shortly after.

Disposal of Dredged Material for Levee Reinforcement

This section addresses the use of dredged material for levee reinforcement. Short- and long-term impacts associated with use of dredged material for levee construction and/or reinforcement are the potential release of contaminants from the dredged material and their possible introduction into surface water and/or ground water. The major reactions resulting in contaminant release are oxidation and acidification. In the water environment, most sediments exist in an anoxic, or oxygen free environment. The diffusion of oxygen in sediment is so slow that the oxygen content declines rapidly with increasing depth. A strong oxygen concentration gradient may exist over a depth of millimeters. Upon transfer of the sediment to land, previously anoxic sediments slowly become oxygenated, or oxidized. This process may take a period of years, depending on the amount of dredged material, the redox potential of the sediment, and the amount of oxidizable matter. During this process, metals, trace elements and other contaminants associated with the oxidizable fractions may be released as these fractions are oxidized. Oxidation of the dredged material may result in acidification of the sediment; this confirms the findings of this study. Oxidation reactions result in the production of hydrogen ions and lower the pH of the sediment. The amount of acidification is dependent on the neutralization capacity of the sediment. Acidification may result in the displacement and release of metals by the increased concentration of hydrogen ions. Rainfall can percolate through the dredged material, and depending on the nature of the material, may carry contaminants to groundwater and soil. Surface runoff from rainfall can flow over the dredged material, carrying the contaminants into surface waters. The potential for loading of contaminants into the aquatic environment are a potential concern to aquatic life or human health if concentrations are above water quality standards.

Exposure of Contaminated Sediments

A long-term impact associated with the removal of sediments during dredging is the potential exposure of contaminated sediments. Mining and other sources of pollution can result in contamination of surface sediments. Over time, deposition of upstream sediments can bury the contaminated sediments, effectively sealing them off from the aquatic organisms. During the dredging activities, the upper layers of sediment are removed, potentially exposing previously contaminated sediments. Benthic organisms are exposed to the contaminants through uptake from pores, body walls, respiratory surfaces, and through ingestion. There is also the possibility that dredging may remove more contaminated sediments and expose less contaminated sediments, thereby improving the benthic habitat.

[4] WATER HYACINTH (*Eichhornia crassipes*)

This study revealed the presence of water hyacinth congregated around the bridge location. The environmental impacts of water hyacinth observed during this study are discussed below.
Water hyacinth is one of the worst weeds in the world – aquatic or terrestrial (Holm *et al.,* 1977). Its floating mats can weigh up to 200 tons per acre.

Economic Importance

Water hyacinth is listed as one of the most productive plants on earth and is considered the world's worst aquatic plant. It forms dense mats that interfere with navigation, recreation, irrigation and power generation. These mats competitively exclude native submersed and floating-leaved plants. Low oxygen conditions develop beneath water hyacinth mats and the dense floating mats impede water flow and create good breeding conditions for mosquitoes. Water hyacinths are a severe environmental and economic problem in many areas of the world with a sub-tropical or tropical climate. This species has rapidly spread throughout inland and coastal fresh water bays, lakes, and marshes in Nigeria and in other countries.

Environmental Impact

- Eichhornia crassipes mats clog waterways, making boating, fishing and almost all other water activities, impossible. This explains findings by the researcher during this study of the reluctance of fishermen to fish around the bridge location, as a result of the accumulation of water hyacinth in the area.
- Water flow through water hyacinth mats is greatly diminished
- An acre of water hyacinth can weigh more than 200 tons; infestations can be many, many acres in size; mats may double their size in as little as 6 – 18 days (Mitchell 1976).
- Water hyacinth mats degrade water quality by blocking photosynthesis, which greatly reduces oxygen levels in the water, blocking the air-water interface, eliminating underwater animals such as fish (Penfound & Earle 1948). This creates a cascading effect by reducing other underwater life such as fish and other plants. This probably explains low dissolved oxygen level in one of the bridge stations and the reduction in fish catch and species distribution around the bridge station.

- Water hyacinth greatly reduces biological diversity: mats eliminate native submersed plants by blocking sunlight, after emersed plant communities by pushing away and crushing them, and also alter animal communities by blocking access to the water and / or eliminating plants the animals depend on for shelter and nesting (Gowanloch, 1944). The presence of water hyacinth around the bridge location can also contribute to the alteration of the area as a spawning ground. This probably explains a low species distribution in the area observed during this study.

[5] NOISE & VIBRATION EFFECTS
A social survey conducted in the study area with the aim of obtaining information prior and during the bridge construction revealed the following:

1. huge pillars were driven into the river bed as framework to support the massive boulders,
2. the noise/vibration generated during this activity was very enormous, and
3. Fishermen usually come out in the morning to see fishes in shock and often killed littered all over the place.

Construction of the bridge would generate noise from equipments such as motors, chain saws, front-end loaders, cranes, pile drivers, power generators, and diesel-fueled trucks. The effects of construction noise would be most noticeable in the area immediately surrounding the construction site. Construction noise in these areas could disrupt residential activities (HDR Alaska, 2001).If blasting with explosives and pile driving is required during construction, vibration as well as noise would be generated. In-water blasting and pile driving would generate pressure waves that would pose a consistent and adverse threat to fish and other marine resources.

BIOLOGICAL MONITORING

Biological monitoring tracks the health of biological systems. Measuring and evaluating the condition of biological systems, and the consequences of human activities for those systems, is central to biological monitoring. It aims to distinguish between naturally occurring variation and changes caused by human activities. Biological assessments are evaluations of the condition of waterbodies using surveys and other direct measurements of resident biological organisms (macro invertebrates, fish, and plants). Biological assessment results are used to answer the question of whether waterbodies support survival and reproduction of desirable fish, shellfish, and other aquatic species -- in other words, if the waterbodies meet their designated aquatic life uses.In the past, chemical criteria and related monitoring have been the traditional mechanism employed by regulatory agencies responsible for protecting aquatic life and assessing the condition of surface waters. Significant improvements in water quality have been made in the last several decades utilizing this approach. However, human actions impact a wider range of water resource attributes than water chemistry alone can measure. The degradation of Minnesota's surface waters can be attributed to a multitude of sources including: chemical pollutants from municipal and industrial point source discharges; agricultural runoff of pesticides, nutrients, and sediment; hydrologic alteration from stream channelization, dams, and artificial drainage; and habitat alteration from agricultural, urban, and residential development (MPCA, 2005). Biological communities are subjected to the cumulative effects of all activities and are continually integrating environmental conditions over time. They represent the condition of their aquatic environment. Biological monitoring is often able to detect water quality impairments that other methods may miss or underestimate. It provides an effective tool for assessing water resource quality regardless of whether the impact is chemical, physical, or biological in nature. To ensure the integrity of surface waters, the relationship between human induced disturbances and their effect on aquatic resources, must be understood.

WATER QUALITY OF STUDY AREA

Aquatic organisms can be negatively affected by water quality problems. This section describes how the water quality of Nun River is assessed using two different types of data, biological and physico-chemical, to give as complete a picture as possible. Biological surveillance is the only means whereby changes to the riverine ecology can be detected, and it forms the essential complement to the longer-established physicochemical monitoring of water quality (ENFO, 1999). Broadly, it may be said that:

Physico-chemical monitoring will measure the causes of pollution and the quantity of pollutants, and **Biological** surveillance will measure the effects of pollution.The rivers and streams are influenced by the surrounding land uses and land management practices. Water quality is generally excellent in upland bush areas, but deteriorates markedly in urban and lowland farming areas

Water in rivers, aquifers, and lakes naturally contains many dissolved materials, depending on atmospheric inputs, geological conditions, and climate. These materials define the water's chemical characteristics. Its biological characteristics are defined by the flora and fauna within the water body, water temperature, sediment load, and color are important physical characteristics. Water "quality" is not only a function of chemical, physical, and biological characteristics but is a value-laden term because it implies quality in relation to some standard. Different uses of water have different standards. Pollution can be broadly defined as deterioration of some aspect of the chemical, physical, or biological characteristics of water (its "quality") to such an extent that it impacts some use of that water or ecosystems within the water. Major water pollutants include organic material, which causes oxygen deficiency in water bodies; nutrients, which cause excessive growth of algae in lakes and coastal areas—known as eutrophication (leading to algal blooms, which may be toxic and consume large amounts of oxygen when decaying); and toxic heavy metals and organic compounds. The severity of water pollution is governed by the intensity of pollutants and the assimilation capacity of receiving water bodies—which depends on the physical, chemical, and biological characteristics of streamflow— but not all pollutants can be degraded.

The concentration of various parameters in water sample collected from the study area is presented in Table 1

The subsurface water temperature values were within national and international standards (FEPA/WHO) for discharge into inland waters, streams, sewers and drinking water sources. The recorded temperature value for the various stations is suitable to support fisheries.

The pH values for the various stations in the study area were slightly alkaline ranging from 7.4 to 7.6. This agrees with earlier findings from tropical aquatic ecosystems (Welcome, 1986) and these values fall within WHO/FEPA standards.

The recorded turbidity values far exceed recommended WHO/FEPA standards. The results therefore showed that the waters from the various stations were highly turbid and therefore affected the surface water quality of the sampled areas. The high values could be attributed to the organic wastes discharged into the aquatic ecosystem from domestic and municipal activities via surface runoff in the study areas (Ekweozor and Agbozu, 2001). The results indicated that the highest turbidity values of 64NTU were recorded in the bridge stations (Tom-Br 1 & 11). Turbidity is a good indicator of sedimentation and erosion in a catchment. This supports findings from this study of a high level of sedimentation, around the bridge area. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of dissolved oxygen. Suspended particles can clog fish gills, reduce resistance to disease in fish, lower growth rates, and affect egg and fish larval development. As particulates settle, they can blanket the stream bottom and smoother fish eggs and benthic macroinvertebrates (aquatic insects). This supports the indication of a sparse distribution of fisheries around the bridge area (Seiyaboh et al., 2007b). Turbidity can be useful as an indicator of the effects of runoff from construction, agricultural practices, logging activities, and wastewater discharges. Turbidity can also impart color to water. A clear mountain stream might have a turbidity of 1NTU whereas a large river like the Mississippi had a dry weather turbidity of 10NTUs, which compared to the turbidity values of 5NTU recorded at the control station that indicated absence of impact due to bridge construction activities. The influence of this activity however, resulted in the high turbidity of 64NTU recorded within the bridge area and 8-10NTU recorded at the downstream and upstream stations of the bridge area.

The conductivity values of between 87 – 95umhos/cm recorded for the various stations in the study area far exceeded WHO/FEPA standards. This high concentration could be attributed to the continuous discharge of some minerals containing silica, magnesium, potassium, carbonates e.t.c into the river system (Nnodu and Ilo, 2000). The study did not however show any major difference with the various stations indicating that the bridge construction activities did not influence the conductivity of the river to any reasonable extent.The DO values recorded in the various stations located within Tombia community were above the 6-8mg/l recommended by WHO (1985) and FEPA (991) except for Tom-Br 1 which was 4.8mg/l and Tom-Up 11 which was 5.2mg/l. Low DO values indicate that the surface waters are not suitable for drinking and aquatic life (Ekweozor and Agbozu, 2001). However, these values compare favorably with those reported elsewhere by Agbozu (2001) in the Niger Delta freshwater ecosystem. The immediate bridge environment recorded lower DO levels which were related to the high turbidity recorded in the area.

The BOD values of between 2.6 – 4.3mg/l recorded for the various stations in the study area were within recommended standard limits by WHO/FEPA except for one of the bridge stations (Tom-Br 11) which was 4.3mg/l. The level of BOD of 2.6 - 4.3mg/l show some type of relationship with the high turbidity recorded in the river system, as with increased turbidity there will be increased biological activity. The observed BOD in Tom-Br 11 is an indication of high organic load in the waters sampled. This could be responsible for the sparse distribution of fisheries observed in the bridge stations.The total dissolved solids values of between 62.1 – 67.9mg/l recorded in the various stations in the study area were below WHO/FEPA standards and therefore could not constitute environmental stress in the study area. The results of this study indicate that TDS values would not affect the water quality, so the bridge construction activities did not affect the TDS values to any reasonable extent as the values did not differ much with stations.

The phosphate concentrations of between 0.06 – 0.14mg/l recorded in the various stations in the study area were within limits recommended for public water supply (Lehninger, 1982) and WHO/FEPA standards. The highest phosphate values of 0.12mg/l and 0.14mg/l were recorded for the bridge stations (Tom-Br 1, Tom-Br11) respectively. The values of 0.12 – 0.14mg/l recorded at the bridge area were higher than those of 0.06 – 0.09mg/l of the other stations. This is indicative of the influence of the bridge construction activities on the phosphate levels of the aquatic system and has a likely influence on the productivity of the water.The nitrate values recorded for the various stations in the study area were within limits recommended by WHO/FEPA for inland waters. The highest levels of 4.12mg/l and 4.15mg/l were recorded in the bridge stations (Tom-Br 1, Tom- 11). Higher values of 4.12 – 4.15mg/l were recorded at the bridge area compared to less than 0.5mg/l at the other stations. The results along with those of turbidity and phosphate indicated the influence of bridge construction activity on the nitrogen levels. These high levels could be attributed to increased sedimentation following the bridge construction activities.

SEDIMENT QUALITY OF STUDY AREA

Sediments are complex environments, with varying physicochemical characteristics, such as content and type of organic matter, particle size distribution, and pH (Ristola, *et al*., 1999).Contaminated sediment is a significant environmental problem affecting many marine, estuarine and freshwater environments throughout the world. Most assessments of water quality have historically focused on water-soluble compounds, with relatively little attention paid to sediment, a repository for sorbed contaminants (UWM, 2005).Concern about sediment contamination and how to assess sediment quality has risen as more information becomes available on the potential adverse effects of sediment contamination. These concerns include:

- Various toxic contaminants found only in barely detectable amounts in the water column can accumulate in sediments to much higher levels;
- Sediments serve as both a reservoir for contaminants and a source of contaminants to the water column and organisms;
- Sediments integrate contaminant concentrations over time, whereas water-column contaminant concentrations are much more variable and dynamic;
- Sediment contaminants (in addition to water column contaminants) affect bottom-dwelling organisms and other sediment-associated organisms, as well as both the organisms that feed on them and humans; and
- Sediments are an integral part of the aquatic environment that provide habitat, feeding, spawning, and rearing areas for many aquatic organisms (EPA, 1996).

Sediment is a very important compartment in the marine ecosystem. Anthropogenic compounds enter the aquatic environment via riverine or atmospheric input. Depending on their physical and chemical properties some substances remain dissolved in the water phase whilst others bind onto particles, sink to the ground and become part of the sediment. In this way, an accumulation of many hydrophobic (and in general strongly adsorbing compounds) takes place. Therefore sediments are assumed to represent a sink for special kinds of pollutants. Due to resuspension processes. However, the compounds can be remobilized again, so that sediments can as well act as a source for contaminants. In order to gain deeper insight into the accumulation of certain compounds and their metabolites, it is necessary to identify and quantify anthropogenic substances in the sediments of ecosystems (Biselli, et.al. 2005).Sediment quality assessments are useful in determining sediment quality in receiving streams of whole effluents, previously impacted sites, and other contaminated areas. The purpose of the sediment characterization task in the study area is to describe the nature and extent of contamination in the sediment of the system, to evaluate the effects of contamination on ecological and human health, and to identify and evaluate remedial action alternatives. Most contaminants of concern are chemically and biologically reactive and rapidly become associated with particles in freshwater systems. Consequently, uptake or sorption onto particles is the primary mechanism for removing chemically reactive contaminants from the water column, and sedimentation is the principal mechanism for the accumulation of these contaminants in off-site areas over long time periods (Cook, et al., 1993).The essence of this section was to assess environmental conditions in the study area by evaluating particle size analysis and measuring the concentrations of parameters in bottom sediments. The percentage of mud (silt/clay) in estuarine sediments can impact both the structure of the biotic assemblage as well as the bioavailability of certain contaminants to local biota.

The sediment analysis data for samples collected in the study area is presented in Table 2

The distribution of the particle size fractions are shown in Tables 2. Particle size is a fundamental physical property of sediment which can inform researchers much about sediment origin, history, transportation and, in some cases, environmental impacts due to activities within the water column. The conditions of transport and deposition of sedimentary particles can also be inferred from the particle size distribution, and the size distribution is also an essential property for assessing how soils or sediment behave under loading conditions like storm waves, oceanographic currents, and earthquakes The results of this study show a higher proportion of sand particles in the bridge station i.e it is characterized by sand sized sediments indicative of a higher energy environment. These results indicate a high degree of sediment deposition and accumulation around the bridge location. The high degree of sediment deposition and accumulation might not be unconnected with the dredging activities following the bridge construction. The amount of sedimentation can deteriorate water quality and maximize the impact of upland activities on the water (Seiyaboh, et. al., 2007a). The area around the bridge location was relatively very shallow, and a social survey conducted in the community revealed that it was not so before the bridge construction. This can have adverse effects on fisheries along the river. Sediment characteristics reflect the sequence of changes that have taken place over time in a given area, and during their formation and digenesis, take an active part in the biogeochemical cycles of the elements that affect the overlying water column through many processes.The pH values for the sediment samples in the various stations studied indicates the presence of an acidic pH in all the various stations sampled, with the pH varying from 4.21 to 5.61. Among the various stations.Tom-Br1 was the least acidic with a pH of 5.61 and Tom-Do111 the most acidic with a pH of 4.21. Sediment pH is one of the most important properties that influences the distribution and abundance of the benthic community and the relationship between ion exchange capacity and nutrient availability (Foth, 1990). Sediments are an integral part of the aquatic environment that provides habitat, feeding, spawning, and rearing areas for many aquatic organisms (EPA 1996). Acidic sediment can have an adverse effect on fisheries. Species distribution in the various stations of this study reflected the influence of an acidic sediment pH (Seiyaboh, et al., 2007b).

The Available Phosphate values recorded in the various stations varied from 2.71 to 17.24mg/g. The highest value was recorded downstream of the bridge (Tom-Do11). The sediment phosphate levels had been shown to follow the same trend as those of the overlying water except that sediment retains more nutrients (Ekeh, 2005). The values recorded in this study of 2.71 – 20.74mg/g were very much higher than those of 2.2 – 2.9mg/g recorded in a previous study in Amadi and Nwaja creeks (Ekeh, 2005). The nitrate values recorded in the various stations varied from 3.11 to 13.40mg/g. The highest nitrate value in was recorded downstream of the bridge (Tom-Do111). Nitrate levels varied within stations with higher values recorded at the bridge area. The values recorded in this study were relatively higher than the 1 – 3.3mg/g (Ikomah, 1999) and 3.07 – 6.47mg/g (Umesi, 1999) previously recorded in various areas of the Niger Delta.

IV. CONCLUSION AND RECOMMENDATION

Despite strong legal mandates and massive expenditures, signs of continuing degradation in biological systems are pervasive- in individual rivers (Karr *et al*., 1985), and around the globe (Hughes and Noss 1992; Moyle and Leidy 1992; Williams and Neves 1992; Allan and Flecker 1993; Zakaria-Ismail 1994; McAllister *et. al.* 1997). Aquatic systems have been impaired, and they continue to deteriorate as a result of human society's action.Despite efforts intended to protect water resources, and some success against certain forms of chemical and organic contamination, the nation's waters continue to decline. The problem has been a failure to see rivers as living systems and a failure to take biological monitoring seriously in management programs. We need a new approach, one that integrates and informs us of the ways our rivers, landscape and society interact.Bridge built across river systems, undoubtedly are sometimes the best option for an easy access, but the final bridge design should be cost-effective and successful at minimizing impact to the river ecosystem. Work should be conducted during the periods that ensured that the fisheries resources were not impacted.A primary goal in every bridge construction project should be to develop construction methods that would minimize or alleviate disturbances to the underlying ecosystem as much as possible. The bridge has to be sensitive to the environment, earthquake resistant and meet safety standards.

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Table 1 Concentration of Various Parameters in Water Samples

S/NO	SAMPLE STATIONS	TEMP (^oC)	pH	TURBIDITY NTU	COND. (umhos/cm)	DO mg/l	BOD_5 mg/l	TDS mg/l	PO_4^{-3} mg/l	NO_3-N mg/l
1	***Tom-Br1***	26	7.5	64	89	4.8	2.9	63.6	0.12	4.12
2	***Tom-Br11***	26	7.5	64	90	6	4.3	64.2	0.14	4.15
3	***Tom-Do1***	26	7.5	18	90	7.2	3.6	64.3	0.08	0.32
4	***Tom-Do11***	26	7.4	15	89	6.8	3.4	63.4	0.07	0.34
5	***Tom-Up1***	26	7.6	10	87	6	3	62.1	0.06	1.7
6	***Tom-Up11***	26	7.4	8	90	5.2	2.6	64.1	0.09	0.38
7	***Tom-Co1***	26	7.6	5	95	7	3.5	67.9	0.08	0.35
8	***Tom-Co11***	26	7.5	5	90	6.2	3.5	64.3	0.06	0.32

Table 2 Concentration of Various Parameters in Sediment Samples

S/NO	SAMPLE STATIONS	PARTICLE SIZE ANALYSIS			TEXTURE CLASS	pH	AVAL. P mg/kg	NO_3-N mg/kg
		SAND(%)	SILT(%)	CLAY(%)				
1	***Tom-Br1***	86	10.2	3.8	Sandy Loam	5.61	15.36	12.3
2	***Tom-Br11***	94	3	4	Sandy Loam	4.71	2.98	4.99
3	***Tom-Br111***	63	2	35	Sandy Loam	4.73	4.54	5.11
4	***Tom-Do1***	36	9	55	Clay Loam	4.82	3.5	7.42
5	***Tom-Do11***	77	2	21	Sandy Loam	4.56	17.24	10.1
6	***Tom-Do111***	66	3	31	Sandy Loam	4.21	15.05	13.4
7	***Tom-Up1***	60.4	2.3	37.3	Sandy Loam	4.73	4.54	5.11
8	***Tom-Up11***	82	6	12	Sandy Loam	5.31	11.2	6.13
9	***Tom-Up111***	59	2	39	Sandy Loam	5.12	10	5.16
10	***Tom-Co1***	72	4	24	Sandy Loam	5.41	10.34	3.43
11	***Tom-Co11***	65	1	34	Sandy Loam	5	2.71	4.11
12	***Tom-Co111***	61	3	36	Sandy Loam	4.82	6.41	3.11