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SWOT Analysis of Ganga Action Plan

GRB EMP : Ganga River Basin Environment Management Plan

by

Indian Institutes of Technology

IIT Bombay | IIT Delhi | IIT Guwahati | IIT Kanpur | IIT Kharagpur | IIT Madras | IIT Roorkee

Preface

In exercise of the powers conferred by sub-sections (1) and (3) of Section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government has constituted National Ganga River Basin Authority (NGRBA) as a planning, financing, monitoring and coordinating authority for strengthening the collective efforts of the Central and State Government for effective abatement of pollution and conservation of the river Ganga. One of the important functions of the NGRBA is to prepare and implement a Ganga River Basin: Environment Management Plan (GRB EMP).

A Consortium of 7 Indian Institute of Technology (IIT) has been given the responsibility of preparing Ganga River Basin Environment Management Plan (GRB EMP) by the Ministry of Environment and Forests (MoEF), GOI, New Delhi. Memorandum of Agreement (MoA) has been signed between 7 IITs (Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras and Roorkee) and MoEF for this purpose on July 6, 2010.

This report is one of the many reports prepared by IITs to describe the strategy, information, methodology, analysis and suggestions and recommendations in developing Ganga River Basin: Environment Management Plan (GRB EMP). The overall Frame Work for documentation of GRBMP and Indexing of Reports is presented on the inside cover page.

There are two aspects to the development of GRB EMP. Dedicated people spent hours discussing concerns, issues and potential solutions to problems. This dedication leads to the preparation of reports that hope to articulate the outcome of the dialog in a way that is useful. Many people contributed to the preparation of this report directly or indirectly. This report is therefore truly a collective effort that reflects the cooperation of many, particularly those who are members of the IIT Team. A list of persons who have taken lead in preparing this report is given on the reverse side.

Dr Vinod Tare
Professor and Coordinator
Development of GRBMP
IIT Kanpur

Lead Persons

1. Vinod Tare, IIT Kanpur
2. Pranjal Dixit, IIT Bombay
3. N C Narayanan, IIT Bombay
4. Subodh Wagle, IIT Bombay
5. Purnendu Bose, IIT Kanpur

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1. Introduction

Ganga, the longest river in India has a unique position in the Indian psyche. Apart from geographical scale and spread, she has played a vital role in the social, cultural, economic and political life of the country. The socio-economic changes in the post industrialization era have adversely affected the flow and quality of the river water leading to pollution of the river. In order to reduce the pollution of this river the Government of India (GOI) has been implementing a pollution abatement program since last 25 years.

This note is primarily aimed at presenting an analysis of the strengths, weaknesses, opportunities and threats (SWOT) of Ganga Action Plans (GAP I and GAP II) — one of the longest and ambitious government interventions which have significantly influenced policies for controlling water pollution in India. This report is primarily based on the secondary data collected, mainly in the form of papers, articles and reports available on the issue of pollution of the river Ganga. The objective of this report is to consolidate—in a systematic manner—the available knowledge and insights in order to understand nuances and complexity involved in design, implementation and monitoring aspects of the Ganga Action Plan (GAP).

The second section of the report presents the need to conduct a SWOT analysis. The third section outlines the objectives and components of the GAP including the parameters selected to measure the quality of the water. Section 4 present strengths and weaknesses of the GAP, in a classified manner, focusing on its design, implementation, monitoring, and regulation aspects of the GAP. These are drawn from both—reports and articles by government agencies and by independent researchers. Section 5 and 6 briefly discuss the opportunities and future threats or challenges of GAP. Finally, the concluding section summarizes the strengths, weaknesses, opportunities and threats in a tabular form.

2. Rationale for Analysis

The rationale for analysis of the GAP could be stated by presenting two arguments. First, the GAP has been the first-ever multi-state, national-level substantial effort for reducing the pollution of the river. Being the first program it has set the precedence for policy-making and program-designs for other rivers in the country. In other words, analysis of this pioneering, trend-setting, initiative have national-level implications in the area of policies and other interventions for cleaning rivers across the country.

Second, the GAP initiative has attempted to address the most complex dynamics around the issue of river pollution. One of the issues is the vast and socio-culturally complex civilization of over 300 million people, out of which a large population live in densely populated cities directly along its banks. Most of the urban centers lack proper sewage treatment facilities. The average population density in the Ganga basin is 520 persons per square km, while the national average is 325. Major cities of Delhi, Kolkata, Kanpur, Lucknow, Patna, Agra, Meerut, Varanasi, and Allahabad are situated in the basin. These cities have large and

growing populations and a rapidly expanding industrial base[1]. Between 1991 and 2001, urban population in the basin has increased by 32%. Population pressures, lack of proper investment in water quality infrastructure, governance problems, and a lack of empowerment of the people all continue to contribute to the deteriorating state of the Ganga. Against this complex background, it is highly important to take a critical look at the strengths, weaknesses, opportunities and threats arising from implementation of the GAP.

Third, GAP is entering into a new phase by adapting a river basin approach. The Central Government itself has accepted that, despite having spent more than 2500 crores of rupees on abatement of the pollution of Ganga in the earlier phases, it has been ineffective and there is a need to revamp the GAP. Revamping of GAP needs a critical assessment of the success and failures of GAP, in an in-depth manner and from various points of views. This document is an effort for presenting a critical analysis of the GAP.

3. Ganga Action Plan: Components and Objectives

3.1. Initial Vision

The idea of cleaning river Ganga was initiated by Government of India (GOI) in 1979; however the GAP could only be initiated in 1985 after a comprehensive survey of the river Ganga by Central Pollution Control Board (CPCB). CPCB had published two comprehensive reports on the pollution issues in the river (CPCB, 1982; CPCB, 1984). These reports formed the basis of intervention activities under GAP. The GAP was aimed at controlling the pollution of this most significant river in a systematic and planned manner.

The core objective of the GAP was to abate pollution and improve water quality. Although GAP also gave importance to: (a) conserve biodiversity, (b) developing an integrated river basin management approach, (c) conducting comprehensive research to further these objectives, and (d) gaining experience for implementing similar river clean-up programs in other polluted rivers in India.

3.2. Program Design

The studies by CPCB indicated that a large proportion of pollution load in the river came from the municipal wastewater generated in twenty-five Class I towns located on the banks of the Ganga, each with a population exceeding 100,000 (NRCD, 2009). It constituted around 75% of the pollution from all point-sources. Remaining 25% of the pollution from point-sources was mainly due to untreated industrial effluent. Therefore, emphasis under the GAP was given on **interception and diversion of wastewater and its treatment in Sewage Treatment Plants (STPs)**, before discharging into river. This strategy involved arresting sewage at the end of the disposal system by intercepting the *nalas* (carrying sewage into the river) and diverting them towards STPs. Similarly, industries releasing

[1]During the course of her journey, the river receives municipal sewage from 29 Class-I cities (cities with population over 1, 00,000), 23 Class II cities (cities with population between 50,000 and 1,00,000) and about 48 other smaller towns. In addition, effluents from industries and polluting wastes from several other non-point sources are discharged into the river Ganga resulting in her pollution.

effluent directly in the river were mandated to establish effluent treatment plants (ETPs) both, in-house as well as common ETPs. In addition to the point-source, non-point sources were also identified, such as disposal of dead bodies, surface run-offs from fields containing residues of fertilizers and pesticides, and crematorium ash. Works were also undertaken to prevent pollution of the river from the non-point sources. These include: introducing electric crematoriums, improving aesthetics of the *ghats*, and promoting public participation. Under the GAP, the schemes corresponding to the point-sources were categorized as 'core schemes' whereas the schemes taken up to address the pollution created by non-point sources were categorized as 'non-core schemes'.

BOX 1: Components of GAP

Core Schemes:

- Interception and diversion (I&D) of sewage, reaching the Ganga-river. (52.32%)
- Installing treatment facilities to treat the intercepted sewage. (36.66%)

Non Core Schemes

- Providing facilities of Low Cost Sanitation (LCS) at community and individual levels at identified locations (7.22%)
- Installation of Crematoria (electric as well as wood based improved crematoria) (0.62%)
- River Front Development (RFD) including bathing Ghats (1.13%)
- Afforestation
- Public awareness and participation (0.32%)

(Source: Presentation to NAC members by NRCD, 2006)

GAP was divided in two phases. Phase-I started in 1985 and covered the then three states, Uttar Pradesh (UP), Bihar and West Bengal (WB). It consisted of core and non-core components listed in Box 1. The choice and design of the core components of the GAP I was entirely based on the survey of CPCB. As mentioned before, the focus in GAP I was on sewage interception and treatment facilities. The classification of the core and non-core components is given in the Box 1 (the percentage-figures indicate the contribution of the particular component in the overall budget).

Thus a large portion of the budget was dedicated to the treatment of urban sewage. Implementation of GAP I started in 1986 and ended in 2008, delayed by 10 years. On the basis of the review of GAP and the felt need of expansion of the program, GOI declared and launched phase-II of GAP in 1993, when the implementation of GAP-I were even not reached halfway. Implementation of GAP-II is still under progress in five states, viz. Uttarakhad, UP, Bihar, Jharkhand and WB. The components of GAP-II were same as the GAP-I, as it was just an extension of GAP-I. Together, GAP-I and GAP-II targeted interception, diversion, and treatment of sewage of more than 37 cities located on the banks of the river Ganga. The relevant data reveal that, until recently, an amount of Rs. 1612.38 crores has been spent on the GAP (MoEF, 2011). [refer Annexure 1 for state-wide details of issues in implementation of GAP-I and GAP-II]

3.3. Institutional Arrangements for Implementation and Monitoring

Development of dedicated and specialized institutional structure was one of the deliberate strategies that the GOI implemented, in order to ensure the effective implementation of the GAP. These institutions were created at all levels, such as the Central Government, the State Governments, as well as, at the level of local governments, i.e. towns and cities. A brief review of the same is presented below.

3.3.1. Institutional Arrangements at the Central Level

Environment, being a subject under the purview of the union/central government, the Ministry of Environment and forests (MoEF) was made in charge of the overall design and implementation of GAP. Central Ganga Authority (CGA) came into existence under the Environment Protection Act 1986, headed by the Prime Minister of India. The CGA, under the chairmanship of the PM, was constituted to finalize the policy framework and to oversee the implementation of GAP-I. The Chief Ministers (CMs) of the concerned states, union ministers and secretaries of the concerned central ministries and experts were its members. An additional agency called Ganga Project Directorate (GPD) was set up with adequate financial and administrative powers in order to implement projects under GAP-I.

As GOI decided to expand its program to all major rivers in India, the GPD was later transformed into National River Conservation Directorate (NRCD), along with transformation of the CGA into National River Conservation Authority (NRCA) in 1995. These changes took place after the commencement of GAP II in 1993. The NRCD designed and is still looking after the implementation of National River Conservation Plan (NRCP) in which the GAP II was merged in December 1996.

3.3.2. Institutional Arrangements at the State Level

At the state level, State River Conservation Authorities (SRCAs) were constituted in all the four concerned states, viz., Uttarakhand, Uttar Pradesh, Bihar, and West-Bengal. These authorities are mandated to function mainly as coordinating as well as monitoring agency for Ganga Action Plans.

Different para-statal agencies were brought in at the state level to actually carry out physical implementation of the drainage interception and diversion work, as well as erection, commissioning and operation and maintenance of treatment plants. For example, in the state of Uttar Pradesh, Uttar Pradesh Jal Nigam (UPJN) has been responsible for building and maintenance of assets under GAP I and II. In Bihar, Bihar Rajya Jal Parishad (BRJP) and in West Bengal, Public Health Engineering Department (PHED) has been given the responsibilities, respectively.

Multiple institutions were responsible for monitoring of the implementation and operations of the sewage treatment. In addition to the SRCAs, state level offices of the para-statal agencies/state departments and State Pollution Control Boards, Regional Commissioner, District Magistrates also were involved in the monitoring functioning. In addition to

different government agencies, autonomous academic institutions were appointed exclusively for monitoring of river-water quality and performance of sewage treatment plants, such as IIT Kanpur and Patna University. These institutions were given the responsibility of monitoring quality of the river-water for different stretches. However, this arrangement came into existence at a very late stage after GAP started.

3.3.3. Institutional Arrangements at the Town Level

At the local level, the responsibilities of respective implementation, operation and maintenance were rested with mostly the local offices of the para-statal agencies. For example, in Kanpur, the local office of the U.P. Jal Nigam was renamed as Ganga Pollution Control Authority which looked after creation and O&M of the assets. The role of the municipal councils was limited to overseeing the implementation and operation.

For monitoring of industrial pollution, the regional offices of the State Pollution Control Boards (SPCBs) were made responsible. In addition to the SPCBs, 'Citizens' monitoring committees' (CMPs) were an important part of the institutional arrangement. These committees were thought of for monitoring of GAP at the local level. CMPs were to be mainly constituted for monitoring of STPs and sewage related issues of pollution.

3.4. Standards for Water Quality

The objective, at the time of launching the Ganga Action Plan in 1985, was to improve the water quality of Ganga to acceptable standards by preventing the pollution load from reaching the river. The acceptable standards were not defined in particular for GAP. However, in 1987, as per the recommendations of the Menon-Committee constituted for monitoring of GAP, the standards were redefined (See Table I).

Table 1: The Class 'B' Water Quality Standards set by Menon Committee (sourced from NRCD, 2009)

No.	Indicator	Unit
1	Bio-Chemical Oxygen Demand	Maximum 3 mg per liter or less
2	Dissolved Oxygen	Minimum 5 mg per liter or more
3	Faecal Coliform	500 (as most probable number) per 100 ml
4	Total Coliform	2500 (as most probable number) per 100 ml (Maximum permissible)
5	pH	6.5 to 8.5

4. Strengths of GAP

Since beginning, GAP has been criticized on many fronts. Some of the important points of criticisms were: inordinate delays in implementation, irregular release of funds, confusions over roles of government institutions, weak monitoring, and irregular and inadequate operation and maintenance of the assets (Ahmed, 1985; Divan, 1995). On the other hand, the government institutions involved have also been justifying the utility and effectiveness of the efforts taken under GAP, by showing progress on various indicators; and some of the

results have also been corroborated by independent researchers. Since beginning, the environmental quality of the water has been the most severely debated issue among the proponents and critiques of the effectiveness of the GAP. This was mainly because the 'quality' and 'purity' of the water carry different interpretations by people, researchers, implementers, and other stakeholders. These interpretations are influenced by different factors, ranging from religious perceptions to physical-scientific parameters (Alley 1994). Issues over achievement of set quality-related parameters (in terms of DO and BOD), adequacy of parameters, and the technology have also been at the center of the debate among the scientific community. This sub-section summarizes the main points from the critique of the GAP covering the major strengths of the Ganga Action Plan as well as its weaknesses.

4.1. Strengths of Design aspects of GAP

4.1.1. The Strategy of Interception and Diversion of *Nalas*

The strategy of diverting the sewage-flows towards STPs by intercepting *nalas* and constructing a conveyance system with pumping-stations was very important and relevant strategy under the design of the GAP. It was relevant because, the task of treatment of sewage did not need to wait until entire sewage network is established in the cities and towns located on the banks of the river Ganga. Thus, it must be viewed as an important strength of the GAP, as the interception-diversion strategy attempted to hit the origin of the problem on an urgent basis and aimed at controlling further pollution of the river.

4.2. Strengths of Implementation Aspects of GAP

4.2.1. Creation of Institutional Structure

The pollution abatement program under GAP has created and restructured many governing agencies at central, state as well as at the local levels. Establishment of this fairly broad institutional structure (though with many internal lacuna) indicates the willingness and commitment of the government to implement the program.

4.3. Strengths of Operation and Maintenance Aspects of GAP

Although, forcing state and local governments for taking over the financial responsibilities pertaining to O&M through judicial interventions (mainly inspired by civil society) cannot be called as strength of the design of the program alone, it is strength of the GAP in a different sense. Such interventions create the basis for future policy designs about tariff policies of the ULBs as well as funding responsibilities of the state governments with respect to Ganga.

Initiatives such as providing diesel pump-sets to keep STPs running during load-shading schedules and in the times of absence of electricity supply was an important step too.

4.4. Strengths of Monitoring, Evaluation and Regulation Aspects of GAP

4.4.1. Peer Review and Monitoring through Various Stakeholders

The responsibilities of monitoring and evaluation of GAP were assigned to different agencies at different levels. It includes: right from the top level CGA, CPCB and NRCD, at the state level, SRCDs and para-statal agencies such as UPJN, SPCBs and other ministerial agencies (eg. a special agency created by UP government which acts as a link-agency between UPJN and Cabinet Ministry), Regional Commissioner at the regional level, as well as, District Collector, ULBs and local offices of the SPCBs and para-statal agencies. Establishment of institutions itself was a strength as it followed the peer-review principle within the government institutions.

4.4.2. Appointment of Independent Agencies for Water Quality Monitoring

Monitoring of river water quality by different academic as well as public institutions was the integral part of monitoring mechanisms of GAP. Accordingly, many autonomous institutions (such as IIT Kanpur, University of Patna) have been monitoring river water quality (sample collection and testing) as per the methods prescribed by CPCB/NRCD by collecting sample in different stretches of the river Ganga. In order to assess the quality of river 44 parameters were selected for monitoring. These assignments have been given to these institutions on research and development (R & D) basis by the government. This has resulted in creation of database on river water quality and may be viewed as an important strength of the monitoring mechanism, and shows willingness and openness of the government for transparent and third party monitoring.

4.5. Other Achievements/Strengths of GAP

4.5.1. Creation of Knowledge Base

GAP also gave rise to many studies of different pollution aspects of the river Ganga. These studies were conducted by various national and international institutions of high repute. Many researchers with high level caliber were engaged in the analysis of different aspects of pollution including ways for abatement of pollution, institutional structures for it, as well as assessment of the GAP. There is a great scope for drawing from these reports, including the court interventions in order to learn from the past efforts and their successes and failures.

4.5.2. Awareness Building among Different Government Agencies

The GAP has now a history of almost 25 years. The two consecutive plans for pollution abatement have kept various governments (viz. local, state, and central) and their agencies functional on this issue for almost two decades. Officials and employees of the state departments are aware of many issues and, now, possess a wealth of knowledge regarding the pollution of the Ganga-river. Agencies such as pollution control boards have been made far more functional on this issue, which is one of the important outcomes of the Ganga Action Plan.

4.5.3. Awareness and Activity among the Non-Government Actors

GAP although initiated by various central and state government agencies, the contribution of civil society organizations has been significant. The civil society organizations have brought many aspects of the pollution to the fore as well as forced government agencies to take effective action. Involvement of the judicial institutions, though not much effective, was a result of relentless efforts by the civil society organizations. Their involvement has kept the issue alive at different levels as well as on different forums. This might not be viewed strictly as one of the achievements of the GAP, however, it can certainly be viewed as an important opportunity that could be utilized for future efforts under GRB EMP.

4.5.4. Improvements in River Water Quality

The report on the status of GAP published by MoEF (NRCD, 2009; prepared by AHEC, IIT Roorkee) is the only comprehensive document which argues for improvement in river water quality against the parameters prescribed by Menon Committee, except the coliform levels. The main arguments mentioned in the report are briefly presented as follows.

Dissolved Oxygen (DO):

The report states that "[i]n 22 years of monitoring at 16 stations, the value of DO below 5.0 mg/l was recorded only in 2.6% cases. In these cases, the values were between 3.2 and 4.9 mg/l. These were observed between Kannauj and Kanpur. A comparison of results with pre-GAP period shows that there is a marginal increase in DO values indicating improvement in water quality" ……. (NRCD, 2009)

Biochemical Oxygen Demand (BOD):

The report suggests higher variation in BOD values as compared to those of DO. It shows that, in 27% of total samples, BOD values were more than the prescribed norm of 3 mg/l. All these samples were mainly taken during lean flows from the middle stretch that starts from Kannauj and ends at Allahabad. The data collected from autonomous monitoring agencies and compiled by CPCB shows that even in the middle stretch, the summer averages of the BOD values in 2010 are reduced to almost half of those recorded in 1986 (CPCB, 2010).

5. Major Weakness of GAP

5.1. Weakness of Design aspects of GAP

The design of the GAP is said to suffer from five important lacunas. These are briefly summarized as follows.

5.1.1. Limited Scope of Issues Addressed

The design of the GAP placed activities such as diversion and treatment of the sewage at the core of its interventions. The non-core schemes under GAP, which attracted meager funding, revolved around crematoria and beautification of bathing *ghats*. It is argued that, although extremely important, excessive emphasis on sewage collection, conveyance and treatment shows lop-sidedness of thinking as well as strategizing underlying GAP. This has proven inadequate because it overlooked the fact that, in different stretches or segments of

the river (viz. upper, middle, and lower) issues and problems are different and are caused by different types of natural conditions and human interventions.

Intervention activities designed under the GAP also betray failure in considering issues that apparently are not connected with the pollution of the river or are indirectly connected. The first such important issue is diversion of the water from Ganga for industrial and agricultural uses in huge quantities. The upper and lower Ganga canals have diverted almost entire amount of the river flow in Uttar Pradesh. This diversion has reduced the capacity of the river to absorb pollution as absence of adequate flows has affected the process of dilution.

Similarly, the pollution from non-point sources was also not adequately addressed in the design of the GAP. For example, the entire set of core and non-core activities does not contain any activity to control the pollution from run-off from agricultural fields, which brings non-biodegradable pesticides into the river.

5.1.2. Inadequacy of Standards of Water Quality

Experts argue that, the discharge standards prescribed by the CPCB (refer Table 2) and those set by the M. G. K. Menon committee (Refer Table 1 given in subsection 3.4) for monitoring of water-quality in the river Ganga are inconsistent with each other. In fact the standards stipulated by CPCB are based on scientific investigations (refer Table 2, Row-2 for comparison). However, according to experts the norms prescribed by the Menon Committee are fixed rather arbitrarily and do not hold scientific justification.

Secondly, the experts argue that the very idea of fixing standards to the 'bathing-class' indicates that this thinking is exotic, imported from the western developed countries, and is rather inadequate on the background of religious rites practiced along the banks of the river Ganga. Western countries fix standards for water-quality up to the 'bathing-class', because, river-water is seldom used directly for 'human-contact uses'. Whereas in India, pilgrims and even the dwellers on the banks of Ganga take a holy dip in the water and practice religious offering, even drink water (called '*arghyam*' and '*achman*'). Many villages located on the banks of the river Ganga use river water directly for drinking purpose in rural areas. Obviously the objective, considering these religious and other practices, should be to keep river-water clean or pure to its pristine level of purity and norms should set up, up to a level of 'drinking-class' that is Class-A from consideration of faecal contamination (see Table 2, Row 1).

Table 2: The Designated Best-Use Classification for Inland Waters (by CPCB) ***(Source: NRCD 2009)***

Class	Designated Best Use (DBU)	Criteria	
A	Drinking Water Source without conventional treatment but after disinfection	pH	6.5 to 8.5
		Dissolved Oxygen (DO)	6 mg/l or more
		Biochemical Oxygen Demand (BOD)	2 mg/l or less
		Total Coliform	50 MPN/100 ml
B	Outdoor bathing (Organized)	pH	6.5 to 8.5
		Dissolved Oxygen (DO)	5 mg/l or more
		Biochemical Oxygen Demand (BOD)	3 mg/l or less
		Total Coliform	500 MPN/100 ml
C	Drinking Water Source With Conventional treatment followed by disinfection	pH	6.5 to 8.5
		Dissolved Oxygen (DO)	4 mg/l or more
		Biochemical Oxygen Demand (BOD)	3 mg/l or less
		Total Coliform	5000 MPN/100 ml
D	Propagation of wild life and fisheries	pH	6.5 to 8.5
		Dissolved Oxygen (DO)	4 mg/l or more
		Free Ammonia	1.2 mg/l
E	Irrigation, industrial cooling and controlled waste disposal	pH	6.5 to 8.5
		Electrical Conductivity	2250 mhos/cm
		Sodium absorption ratio	26
		Boron	2 mg/l

5.1.3. Influence of Aid on Choice of Technology

One of the important issue in the debate is the choice of technology for sewage treatment under the GAP, especially the Up-flow Anaerobic Sludge Blanket (UASB) technology introduced with the Dutch development aid which was an important financial source for the GAP-I. The critics argue that while adapting the technology, the MoEF did not carry out any comparative assessment of the sewage treatment technologies on the criteria of suitability or efficiency (Menon, 1988). Further they argue that the choice of UASB was highly influenced by the Dutch aid and resulted into a mere waste of resources.

5.1.4. Inappropriate Technological Choices for Treatment

The other technologies adapted by GAP such as Activated Sludge Processes (ASP) were capable of treating sewage only up to the standards prescribed for DO, BOD and COD. They were opted because; the standards themselves were set to achieve water quality up to the 'B Class-Bathing' standards. However, these technologies are highly incapable in terms of removing pathogens and coliform, i.e. the bacterial contamination. The water quality data show high level of presence of pathogens and coliform across all the stretches of the river Ganga, despite implementation of GAP (NRCD, 2009). Disinfection as an important way to kill pathogenic organisms could be achieved by employing several methods using two approaches: (a) by using chemicals and (b) by employing filtration techniques. Importantly,

under GAP all these methods such as chlorination, ultra-violate treatment; solar-based techniques (sodies), ozonation were used after secondary treatment of the sewage. However, all methods proved ineffective. All these methods had limitations in disinfecting the sewage water after secondary treatment. For example, chlorination process has limitation, as the extent of the chlorine used for disinfection could not be increased beyond a certain value. If it is used more than prescribed norm it can be harmful to aquatic life. Similarly, the UV technology has limitations as it is expensive and ineffective on secondary effluents. There are certain limitations with sun based methods as well as ozonation too[2]. This gives more substance to the argument for adapting different standards and level of treatment.

Comparison between conditions of water in Indian rivers with the water in western rivers would be helpful in this context. The rivers in Europe and other western countries are either snow-fed and/or rain fed for at least 120 days in a year, whereas, flows in Indian rivers last merely for 30-60 days during monsoon. Despite having adequate flows for dilution of the discharged effluent, western countries treat water up to the tertiary level. The Indian model of treatment proposes treatment up to secondary level only, despite having lean season of water flows of 10 months. This results in further degradation of the water quality of the river in terms of fecale contamination. Thus, the case for tertiary level treatment of the effluent and sewage finds further substantiation due to these experiences with the technologies adapted for eliminating or reducing microbial contamination, and western practices of tertiary level treatment despite adequate flows in the rivers.

5.1.5. Inappropriate Policy of Discharging Water into the River

Discharging partially treated sewage or effluent in the river is an acceptable practice as far as the following conditions are met: (a) The river-flows are substantial; (b) The sewage or effluent treatment plants are operated with full capacity and diligence under effective regulation. First, the adequate water flow in the river is particularly required for dilution of effluent, which reduces the danger of further degradation of the quality of the water. Second, the treatment plants should also treat the entire sewage and effluent that is diverted or directed to them. It means STPs and ETPs should never be set up on a by-pass mode. This requires effective operation and maintenance of assets, as well as equally effective monitoring and regulation of the same. However, in the case of the assets created under GAP, both these conditions are not met. Due to large scale diversion of water for industrial and agricultural purposes the middle stretch of the river becomes almost dry in the lean season, which intensifies the pollution (Gyawali, 1999). Similarly, the irregular operation and inadequate maintenance of assets have been an important issue with the GAP-assets, which has resulted into further degradation of the quality.

[2] For details refer: Compendium of sewage and effluent treatment technologies, could be sourced from www.moef.nic.in

5.1.6. Lack of a Clear Policy-Legal and Institutional Framework

A loose and vague policy and legal framework, especially the lack of clarity about the roles of various stakeholders involved in the implementation of the GAP, have been important weaknesses of the very design of GAP. The lacunas and gaps in the existing pollution abatement laws create many ambiguities and gaps which allow departmental discretions to play a decisive role in implementation of the program. These ambiguities have also paved the way for many weaknesses of the GAP itself.

Similarly, multiplicity of institutions is another result of the lack of clear policy-legal framework. The failure of institutional mechanisms created by Ganga Action Plan could be traced to the overlaps and conflicting jurisdictions of the government agencies (departments, para-statals, government-agencies working at various levels). These have caused many problems (as discussed in 2.4.1) for decision-making and implementation of GAP (CDP-Kanpur, 2006).

5.2. Weakness of Implementation

5.2.1. Political Motivations behind the GAP

Since very beginning, this ambitious plan was perceived as highly politically motivated, especially in choosing Ganga as the first river to be cleaned up (EPW, 1985). It was perceived that the official references to the importance of controlling pollution in Ganga have been invariably couched in the appeal to the religious sentiments of Hindus. However, the very effort of appealing the religious sentiments seems to have proven mis-directed because of the wide-spread and deep-rooted cultural belief that this sacred river can never get polluted. The politicians soon realized the futility of GAP in terms of appealing the sentiments of Hindus and gaining political mileage from it. The large scale apathy from the common citizenry about the GAP despite large-scale aggressive media/civil society campaigns as well as court interventions could be attributed to these reasons. This situation underlines the importance of the political motivation in implementing programs such as GAP, but the future course of action does not consider this element in its design.

5.2.2. Inordinate Delays in Creating Assets

Many reasons have been cited for inordinate delays in implementation of GAP. The Public Accounts Committee (PAC) appointed by the *Lok Sabha* to assess the performance of GAP came out with instances and references for many administrative and other delays. The most common reasons cited by the committee are (PAC, 2004):

1. Confusions and tensions among the central and state governments over the issue of funding for assets to be created under GAP. For GAP-II, initially, the arrangements were 50:50 cost-sharing basis, then it was changed to 70:30 pattern and, finally the central government provided 100% funding (except the land costs). Even after these changes, the funding pattern was again changed many times under the 10th Five Year Plan.

2. The selection of towns under GAP II was completely left to the state-level decision making, which resulted in non-uniformity in the selection as well as delayed the process of preparation of project-proposals.
3. Majority states could not acquire or provide land for constructing the sewage treatment plants and pumping infrastructure within the prescribed time which delayed the implementation of the program.
4. The state governments could not prepare the Detailed Project Reports (DPRs) in time, and according to the guidelines issued by the NRCD, MoEF. The quality of the DPRs was poor, and due to the discrepancies in them, the sanctioning process could not be conducted in the stipulated time.
5. Problems created by court-cases, contractual issues, and inadequate capacities in the local bodies/implementing agencies came in the way of speedy implementation.
6. Cost-overruns and re-sanctioning of the schemes also led to time-wastage and further delayed the process.

5.2.3. Partial Coverage for Collection, Conveyance and Treatment of Sewage across Cities in the River-Basin

Issues related to coverage by sewage collection, conveyance and treatment systems have been largely responsible for partial treatment of sewage. These issues seem to be present at different levels, such as: (i) coverage of *nalas* within the cities, (ii) coverage of cities and towns (iii) coverage of rural population. Some of these issues are discussed briefly in the following paragraphs.

1. *Coverage of nalas within the cities*: Under the GAP-I, in many of the Class-1 cities interception and diversion works did not cover all the *nalas* that discharged sewage into the river. Due to partial coverage, remaining sewage was allowed to be released into the river through *nalas* and, thus pollution continued. Moreover, it is said that among all the STPs constructed under GAP roughly 20% of the STPs were overloaded, which could not treat all the sewage conveyed to them and some untreated sewage polluted the river. These factors resulted in partial treatment of the sewage reducing the effectiveness of the interventions of GAP. Speedy, amorphous, and unplanned urbanization was not accounted for in the GAP-I as well as GAP-II. It was necessary to undertake specific measures for prevention of pollution of the river water, while planning new settlements or expansion of the present ones, which remained neglected.
2. *Coverage of cities and towns*: The coverage was restricted to only 25 Class-I cities during GAP-I. Later, GAP was expanded to cover 27 more Class-I cities. However, Class-II, Class-III and Class-IV towns were left uncovered as far as collection and treatment of sewage was concerned.
3. *Coverage of rural settlements*: The decision not to cover rural settlements was also considered a major hurdle to the success of GAP.

5.2.4. Over-Designed STPs

Generally the STPs were designed considering the following three main factors (a) population of the cities and towns, (b) projections of the growth of the population, and (c) standards based on per capita sewage generation. In many cases these calculations resulted in STPs with large capacities. As a result, in practice, sufficient amount of sewage could never reach to the STPs, largely due to inadequacy of the sewer networks as well as the inadequate interception and diversion of sewage flowing through the *nalas* (CSP- Kanpur, 2009). Roughly, it is said that, 80% of the STPs remained 'under-loaded', which resulted in dead-investment on the STPs.

5.3. Weakness of Operation and Maintenance

5.3.1. Irregular Maintenance

Operation and maintenance of GAP-assets has been the responsibility of Urban Local Bodies (ULBs) or state government agencies. However, ULBs did not have enough resources for this purpose and states were inconsistent in releasing the money for operation and maintenance. The critics further say that states never give due importance in their funding for operation and maintenance of GAP assets. Even after court-interventions, states addressed the issue with limited seriousness. Municipal councils faced problems raising required financial and human resources to ensure proper operation and maintenance (Shaw, 2006).

5.3.2. Sub-Optimal Functioning of the Assets

Irregular maintenance of the assets and failure to ensure a full coverage by the sewage-collection network led to sub-optimal functioning of the assets installed for sewage and effluent treatment. Irregular electricity supply kept the pumping stations in an 'On & Off' mode for many years after installations. Finally, in response to a writ petition filed in Allahabad High-court by an NGO and subsequent directions by the HC, the state government of UP provided diesel-engine sets to operate pumps during load-shading schedules. Nonetheless, it has been alleged that many times diesel engine sets also do not work because of irregular supply of diesel by the state authorities (Biswas, 2002). Suboptimal functioning of ETPs and STPs also has forced the farmers around Kanpur to irrigate their farmlands with partially treated, polluted water casing health problems to the farming dependent population (Singh, 2001).

5.3.3. Unclear, Unviable Financial Models

The policies and programs implemented under GAP lacked clear financial models, and did not have a balanced arrangement of effective incentives, disincentives and penal provisions. In fact, the entire funds put in the GAP hitherto should have been viewed as *investment.* Nonetheless, the funds should have been multiplied 20 times in the form of a turnover of a treatment sector, from the initial figure of investment, through an appropriate finance and business model. However, this did not happen and the government agencies today are left with eroded assets with no more life remaining. This did not happen precisely because it

lacked a clear arrangement of financial incentives wherein all concerned stakeholders (both, from public and private spheres) could be engaged in a business activity which would have served interests of all the engaged through achieving the basic objective of treatment of sewage. This involves creating a proper mix of incentives and disincentives with effective regulatory arrangements. For example, incentives and disincentives for establishing a treatment market, or for establishing a decentralized sanitation systems, or for proper arrangements for buy and sell of treated sewage and so on, as indicated in the 'DBFO' model (Consortium of 7 IITs, 2010: Report No.: 004_GBP_IIT_EQP_S&R_03_Ver 01 Dec 2010).

5.4. Weakness of Monitoring, Evaluation and Regulation

5.4.1. Neglect of Monitoring of Important Aspects Other Than the River-Quality

The Government did not make any arrangements to monitor many important issues associated with the river and contamination of its water such as, erosion, tree cover. For example, tree cover in the Ganga basin has reduced considerably and land-use patterns have changed, which has led to an increase in soil erosion. This seriously affects flows in the river. The monitoring mechanisms also missed aspects such as sediment yield and sediment deposition on the river bed, as well we some key areas such as watershed development and interaction of surface-water and groundwater.

5.4.2. Failure to Utilize Available Monitoring Data

The data collected hitherto was neither put together in a cohesive manner nor analyzed independently. Because of this neglect of data-analysis, lessons could not be drawn for further analysis of O&M as well as for designing new initiative in order to reduce the pollution. Thus, this neglect led to not utilizing the lessons learned from past experiences in an effective manner and has raised questions on government spending on monitoring programmes.

5.4.3. Failure in Controlling Industrial Pollution

By the end of the first phase, only about 45 per cent of the grossly polluting industrial units had installed ETPs. Over 18 per cent of those did not function properly, and did not meet the technical standards. These units discharged industrial effluent of 2667.16 MLD into the rivers. The NRCD had no mechanism to ensure that the installed plants functioned satisfactorily, other than SPCBs (PAC, 2004). The participants in the debate over tackling the industrial pollution also argue that GAP has failed to tackle the issue of industrial pollution effectively, especially because of its thrust on the sewage treatment plants.

The monitoring of construction of ETPs, operation of ETPs and discharge of industrial effluent is marred by weak mechanisms for monitoring under GAP. Due to the sub-optimal operation or non-operation of the ETPs, discharge-standards were rarely met as far as the industrial effluents are concerned. In fact, CPCB and SPCBs have sufficient powers to close

down the operations of the polluting industries; however, PCBs could not take effective actions due to the political interventions. For example, paper and pulp industries, sugar factories and distilleries along the banks of the rivers Ramganga and Kali near Kannuaj have continuously been discharging industrial effluent into Ganga which, despite repeated complaints have not been closed down or forced to construct and run the ETPs. This has created a major problem of color in the river-water, and has been a major cause of suffering of the people at Allahabad during religious gatherings and mass-bathing events.

5.4.4. Weak Monitoring by Central Institutions

Failure of government institutions in monitoring of the program was one of the major critiques. As the Public Accounts Committee pointed out in its report, the apex body headed by the Prime Minister to monitor the plan, viz. National River Conservation Authority, met only twice, in 1994 and 1997 (PAC, 2004). The states were asked to set up Citizen Monitoring Committees which were supposed to ensure public participation in the schemes. Haryana, Bihar and Delhi governments did not constitute such committees in any of the towns and West-Bengal constituted committees only in 5 out of 42 towns. The constituted committees in West Bengal and Uttar Pradesh met only infrequently. Thus, both at the central and the state level, monitoring of the plan was highly inadequate (CAG, 2000).

5.4.5. Failure in Establishing Citizen's Monitoring Committees

The participation of stakeholders has not been effective in implementation of the GAP. There were provisions to constitute the citizens monitoring committees; however, in practice, these committees either were not constituted at all or did not function effectively (PAC, 2004). This situation occurred partly because of the political aspects of constituting committees and partly because of the low repose from the citizens.

5.4.6. Flaws in the Design of Citizen's Monitoring Committees

The very design of the Citizen's monitoring committees (CMC) was flawed. The CMCs were constituted at the city or town level, in which, Mayor of the town was made an ex-officio chairperson of the CMC. This provision assigned a key role to the mainstream political forces and caused concentration of powers in the hands of dominant sections. Further, critics argue that, this provision reduced the strength of third-party monitoring as it mixed the responsibilities with the powerful local government.

Another observation shows that there was little sense of ownership among the stakeholders due to their limited participation in formulating schemes and in implementation. In public perception, the plan continues to be seen as a government scheme.

6. Opportunities for Future

6.1. Experiences with Technologies

A variety of treatment technologies have been experimented under the GAP. Up-flow Anaerobic Sludge Blanket (UASB), Activated sludge Process (ASP) and the Stabilization Pond

Technology are the three main technologies used for treating sewage. Government authorities have a fair understanding of strengths and weaknesses of these technologies by now. For example, it is known that UASB technology is land-intensive and has constraints in treating the sewage with varying values of DO, BOD and coliform in the treated effluent. Similarly it is also clear that the ASP technology demands more energy. The effectiveness of these technologies, in terms of improving the quality of the water is also varied. The ministry has come out with a compendium of sewage treatment technologies recently (Tare and Bose, 2009). This experience has to be leveraged upon while employing new technologies.

6.2. Adaption of River Basin Approach

Adoption of the River Basin Approach (RBA) is an important perspective-level shift in the thinking around cleaning the Gaga-waters. This is important particularly because it addresses the question of pollution in a much broader sense and considers all possible sources of pollution in the basin by basing itself on the principles of a watershed. It is important to consider the vast expanse of the Ganga River Basin and give importance to both quantity (*aviral dhara*) and quality of water (*nirmal dhara* or un-polluted flow). The river Ganga travels for more than 2500 km, and the geographical area of the basin accounts for 26 per cent of the country's landmass, 30 per cent of water and 40 per cent of the population (Dharmadhikary, 2011).

6.3. GOIs Commitment to Raise Adequate Funds

The government, in the paper written by NRCD, has explained commitment to raise funds for subsequent phases of Ganga Action Plan. The strategy described in the future course of action assures approaching all possible agencies for raising financial resources such as, ULBs, state governments, central government as well as the bilateral and multilateral funding.

6.4. Awareness and Inclination to Contribute

Though the efforts to form the citizens committees failed, the participation of the civil society organizations in diverse modes was very crucial in implementation of GAP. These modes included: numerous court interventions, setting up of *Ganga-Praharies* to promote vigilance on the banks of Ganga, awareness campaigns on pollution of the river, participation of academia and independent researchers in the research activities such as monitoring of water quality, innovating with the decentralized sanitation systems, etc. The contribution of CSOs in terms of awareness building as well as analysis and monitoring of government interventions is unmatched. There is a great opportunity to leverage these initiatives and participation of CSOs even in development and monitoring of future phases of the GAP.

7. Threats and Challenges

7.1. Divergence of River Action Plan with Broader Development Policies

Despite adoption of the broader river basin approach, the danger of divergence of River Action Plans (RAPs) with the broader development policies (such as policies for industrial development, urbanization as well as sectoral policies like irrigation) is looming ahead. Considering that the central objective of the GAP is cleaning of Ganga, there is a great need to integrate it appropriately with the other broader development policies. If the GAP continues to be implemented without ensuring such integration, many of the deeper problems underlying pollution of water of Ganga will remain unaddressed. Perhaps this is the most challenging threat to address.

7.2. Challenge in Experimentation with Newer Institutional Models

After 1990 reforms, the GOI has been following the policy of private sector participation in almost every sector. The JNNURM scheme is an instance of the same and which aims at addressing different urban problems including the sewage disposal. There is scope for introduction of these reforms in the very design of the activities under Ganga Action Plan in future. However, there is also an equally great threat of failure of reform-models (such as the Public Private Partnership - PPP model) as these models are yet to be proved as robust and effective enough to implement widely.

7.3. Influence of Bilateral/Multilateral Financers on the Program Component

Bilateral and multilateral funding has been an important source for many developmental programs in India. However, there has been a great debate over role of international Funding Institutions (IFIs) and unwarranted influence over policy-making and structuring of programs. One of the former Project Director of GAP in one of the forums commented that accepting funding from IFIs including World Bank was one of the mistakes. Even the testing of UASB technology under GAP financed through the Dutch aid attracted criticisms for the same reason. This threat still looms over the future policy-making and program design in the next phases of Ganga Action Plan.

7.4. Capacities and Incentives Structures for ULB

The capacity of the ULBs has been a critical issue. Though the ULBs have very little role in implementation of the GAP hitherto, the ownership of the assets rests with the ULBs. The implementation and operation and management of the assets, have been kept out of the purview of ULBs with the excuse of their weak capacities. The institutions such as city development authorities, (e.g. Kanpur Development Authority) have been blamed for further weakening of ULBs' role in the local governance. This is said to create problems for the construction, operation and maintenance of the assets in the Ganga Action Plan too.

This calls for a robust incentive structure for ULBs. If this factor is not addressed with sufficient gravity and seriousness at the policy level, the threat of failure of future GAP efforts would persist.

7.5. Wastage of Funds

Misuse and wastage of funds is one of the serious challenges. Even today the implementation of projects under the JNNURM program, especially sewerage-projects is facing similar problems. It seems that the central government is not able to exercise effective control over the decisions and actions at the state and local levels, especially pertaining to budget preparation, cost-over runs and quality of the works done. In fact this is the larger governance related problem, which would decisively affect GAP and its objectives.

7.6. The Complexity in Monitoring of Technical Parameters

Failure in utilizing monitoring data (refer subsection 4.4.2) also highlights the important issue of complexity in monitoring of methodological rigor in collecting samples, and testing them in the laboratories. An expert from IIT Kanpur reported that, there are differences of opinions among the autonomous agencies and government officials regarding the reliability of the data-samples and lab test-results. This complexity creates confusions about the validity and acceptability of the values of parameters (or standards) tested, and further complicates the process of monitoring river water quality. The expert further argues that, the Citizen Monitoring Committees (CMCs), though established at one or two instances (for example, once in Kanpur) could not understand these technical complexities and soon lost their interest in monitoring of GAP. This experience highlights the need and the challenge in setting up such norms and parameters that the monitoring mechanisms with no technical background or capacities could also monitor them easily.

7.7. Inadequate Analytical Foundations of Future Plans

The chapter titled 'Critical Analysis of GAP' presented by NRCD in the Status Paper on GAP shows that NRCD has accepted the flaws, mistakes, and gaps in implementation of GAP with an apologetic undertone. The acceptance of limitations of GAP by NRCD, although commendable, is preliminary in nature and lacks an in-depth analysis, especially from the standpoints of different stakeholders involved in implementation of GAP. It misses many aspects such as, the need for analyzing policy and legal aspects of centre-state relationships, implementation of 74th amendment, and State Government-ULBs relationships, as well as, the convergence of policies adapted for implementing GAP with the broader developmental policies.

Despite such severe inadequacy of the analytical foundations, the government is continuing with the implementation of big-budget, flag-ship programs such as Jawaharlal Nehru National Urban Renewal Mission in the Ganga basin. Sewerage schemes and STPs of large capacities are being constructed under these programs in all major cities located on the

banks of the river Ganga. Importantly, the government agencies are committing same mistakes in planning and implementation of the programs such as: over-designing of STPs, choosing and employing UASB technology for STPs, implementing programs without elaborate and detailed process of planning, and implementing programs without clarity of financial models for operation and maintenance. The implementation of these programs without integrating the lessons in the policy and program designs also poses serious threat of wastage and misuse of funds.

7.8. Evolving a Robust Regulatory Framework and Institutional Arrangement

The threats posed by programs such as JNNURM are not only limited to repetition of mistakes committed earlier or wastage and misuse of funds. This is because, JNNURM scheme is not only an infrastructure development program, but also a program which is expected to bring fundamental economic and governance reforms in the functioning of state governments and more importantly in the functioning of local governments. Important reforms such as Private Sector Participation (PSP), principle of cost-recoveries, restructuring of para-statal bodies and establishment of effective regulatory mechanisms have close linkage with the performance of agencies concerned with the GAP. The effectiveness of these reforms largely depends on the designs of institutional structures and time lapses involved in adaptation of reforms at the local level. Especially against the background of the sorry state of implementation of reforms, and complexities involved in restructuring of para-statal agencies, evolving a robust regulatory framework still remains a great challenge before the policy makers of GAP.

8. Conclusion

Table 3 summarizing the strengths, achievements and weaknesses shows that there is a great imbalance in the both strengths and weaknesses of the GAP if looked at critically. The core weaknesses of the GAP in all aspects of design, implementation, monitoring, evaluation, and regulation has defeated the very purpose of the GAP and there is a great scope for learning from these weaknesses in preparing Ganga River Basin Environment Management Plan, and implementation of the same by National Ganga River Basin Authority.

Table 3: Strengths, Achievements and Weaknesses of the GAP

Aspects	Strengths	Weakness
Design of the GAP	• Initial Vision • The Strategy of Interception and Diversion of *Nalas*	• Limited scope of issues addressed • Inadequacy of standards for assessing water-quality • Influence of aid on planning in general, and prioritization of programmes and selection of technologies in particular • Inappropriate choices of treatment technologies • Inappropriate policy of discharging treated effluent and sewage into the river • Lack of a clear policy-legal and institutional framework
Implementation of the GAP	• Creation of the institutional infrastructure	• Political motivations behind GAP • Inordinate delays in creating assets • Partial coverage in collection, coverage and treatment of sewage across cities in Ganga Basin • Overdesigned STPs
Operation and Maintenance of the GAP	• Forcing ULBs and state-governments to pay for the O&M	• Irregular maintenance • Sub-optimal functioning of Assets • Unclear, unviable finance models
Monitoring, Evaluation and Regulation of the GAP	• Peer review and monitoring by various stakeholders • Appointment of independent agencies for water quality monitoring	• Neglect of monitoring of other aspects other than river quality • Failure to utilize available monitoring data • Failure in monitoring and regulating, thereby controlling industrial pollution • Weak monitoring by central institutions • Failure in establishing Citizen's Monitoring Committees • Flaws in design of Citizen's Monitoring Committees
Other aspects of strengths / Achievements		
• Creation of knowledge base • Awareness building among government agencies • Awareness building among civil society actors		

This analysis also points at the different dimensions of broader problem of governance failure, despite some of its achievements. Several issues such as delays in implementation of the program, confusion over funding, technological issues, operation and maintenance of the assets do not only indicate typical governance failures but also clarify the gaps in policy and program design. These gaps also highlight the weakness in program planning/implementation/monitoring/evaluation, center-state coordination, state-ULB coordination, etc. The issues such as multiplicity of institutions, especially at the local level and their conflicting/overlapping roles place the need for a deeper institutional analysis. Opaque implementation and low levels of citizen's participation pose broader challenges for the future design and intervention and demand greater transparency. This calls for a

detailed analysis of the governance-related factors affecting effectiveness of the GAP both within government agencies as well as outside.

Table 4 summarizes the opportunities and threats before the government for designing the river restoration programmes. For example, the adaption of river basin authority is an opportunity; however, it is equally important to develop an understanding of various problems with respect of to Ganga according to its three important stretches viz., the upper, middle and lower stretches of its flow in order to design the future course of action. Each of its stretch is characterized by different types of problems, having different physical conditions as well as dynamics created by distinct political economy. Similarly the cause and effect relationships and inter-linkages of the problems in the upper stretches with the lower stretches also need to be understood. For example upper stretch is characterized by high flows, steep gradients and soil-erosion which demands for different kind of technological interventions than in the lower stretches.

A similar example in the context of diversion of broader development policies with pollution of the river could be cited as: the huge amount of water diversion for irrigation purposes in the upper stretches causes intensification of the pollution in the middle-stretch of the Ganga by reducing flows even below the levels of minimum environmental flows in non-monsoon season. While the decisions to divert water seems highly irreversible considering the influence of high level of political-economy, the failure of STPs in treatment of sewage call for different approaches. Similar inter-linkages in other problems within different stretches needs to be understood properly which calls for evolving a detailed classification of the problem-classification that should be interdisciplinary in nature.

Apart from understanding the inter-linkages among the problems and their social, political, economic and technological aspects, there is a need to understand the institutional aspects of the problems with respect to the GAP too. Here, institutions do not signify mere formal structure of the government agencies (departments and authorities) and their way of functioning alone, but also the ways adopted by government and non-government actors for using gaps and loopholes in the provisions in a diverse manner that cause interventions to be ineffective. It implies developing an understanding of informal ways of decision-making by using the loopholes in the existing laws, rules, and provisions in the laws as well as their interpretation reflected in the functioning of the government agencies as well as implementation of the programs such as GAP.

Table 4: Opportunities and Threats before River Restoration Progrmmes

Opportunities	Threats
• Opportunity to learn from experiences of technologies such as UASB • Adoption of river basin approach • GOIs commitment to raise adequate funds • Awareness and inclination of civil society to contribute	• Divergence of river action plans with broader development policies • Challenges in experimenting with newer institutional models such as regulatory authorities • Influence of Bilateral and Multilateral financers on program and policy- design • Capacity issues and lack of incentive structures for ULBs • Wastage of Funds • The complexity in monitoring of technical parameters • Inadequate analytical foundation for future plans • Evolving a robust regulatory framework and institutional model

Annexure I

State-wise Status of GAP-I and II

Table A1.1: Interception, Diversion and STPs under GAP-I

State	Interception and Diversion				Sewage Treatment Plants			
	Schemes		Sewer Lines, kms		Schemes		Sewage Treatment, mld	
	T	A	T	A	T	A	T	A
Uttar Pradesh	40	40	136.00	136.00	13	13	375.09	375.09
West Bengal	31	31	173.14	173.14	15	14	371.60	341.60
Bihar	17	17	53.71	53.71	7	5	135.50	118.00
Total	88	88	362.85	362.85	35	32	882.19	834.69

[Source: CAG 2000]

Table A1.2: Status of the schemes sanctioned and completed under GAP-II

Status of Progress Under GAP –II				(As on 31-12-2009)			(Rs. In lakh)
No.	Action Plan/State	Cost of Schemes 31-12-2009	Schemes Sanctioned	No. of Schemes Completed (30-09-2009)	Funds Released By GoI (31-12-2009)	Funds Released During 2009-10	Expenditure Incurred (Inclusive of State Share) (30-09-2009)
A	**Ganga Action Plan Phase-II (Ganga River and its tributaries)**						
(I)	**Yamuna Action Plan**						
1	Delhi	18064.08	12	12	17714.54	0.00	16069.53
2	Uttar Pradesh	28266.50	146	146	24001.50	0.00	27323.02
3	Haryana	24220.27	111	111	17870.40	0.00	24826.00
	Total	**70550.85**		**269**	**59586.44**	**0.00**	**68218.55**
	Yamuna Action Plan Phase-II						
	Delhi	46935.45	11	0	12183.72	3000.00	11094.97
	Uttar Pradesh	11507.94	5	1	5852.00	0.00	6644.88
	Haryana	6342.97	16	9	4890.23	1490.00	4949.62
	Sub Total	64786.36	32	10	22925.95	4490.00	22689.47
	Total (Yamuna)	**135337.21**	**301**	**279**	**82512.39**	**4490.00**	**90908.02**
(ii)	**Gomati Action Plan**						
	Uttar Pradesh	5575.09	31	29	4314.72	0.00	5214.66
	Total	**5575.09**	**31**	**29**	**4314.72**	**0.00**	**5214.66**
	Gomati Action Plan Phase-II						
	Uttar Pradesh	26304.22	30	7	16743.46	8023.00	22442.57
	Total	**26304.22**	**30**	**7**	**16743.46**	**8023.00**	**22442.57**
	Total (Gomati)	**31879.31**	**61**	**36**	**21058.18**	**8023.00**	**27657.22**

Status of Progress Under GAP –II				(As on 31-12-2009)			(Rs. In lakh)
No.	Action Plan/State	Cost of Schemes 31-12-2009	Schemes Sanctioned	No. of Schemes Completed (30-09-2009)	Funds Released By GoI (31-12-2009)	Funds Released During 2009-10	Expenditure Incurred (Inclusive of State Share) (30-09-2009)
(iii)	**Damodar Action Plan**						
4	Jharkhand	41.44	4	4	19.81	0.00	36.99
5	West Bengal	398.41	10	10	10.74	0.00	392.20
	Total	**439.85**	**14**	**14**	**30.55**	**0.00**	**429.19**
(iv)	**Mahananda Action Plan**						
	West Bengal	5488.23	3	0	500.00	0.00	1803.36
	Total	**5488.23**	**3**	**0**	**500.00**	**0.00**	**1803.36**
(v)	**Ganga Action Plan-II**						
	Uttar Pradesh	19811.76	45	32	15099.77	1357.00	15967.97
6	Uttarakhand	11486.04	52	29	4907.42	1769.00	3947.42
	Jharkhand	20.67	2	2	0.00	0.00	24.57
7	Bihar	395.18	18	14	315.13	0.00	297.54
	West Bengal	23560.84	202	140	19206.63	2000.00	16250.90
	CETP (West Bengal)	8292.00	4	2	4224.00	0.00	3952.00
	Total	**63566.48**	**323**	**219**	**43752.95**	**5126.00**	**40440.41**
	GAP-II (Total)	**236711.09**	**702**	**548**	**147854.07**	**17639.00**	**161238.20**

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