“Project Formulation Survey” under the Governmental Commission on the Projects for ODA Overseas Economic Cooperation in FY2012

Summary Report

Republic of India

“Feasibility Study on Groundwater Remediation by Bioremediation”

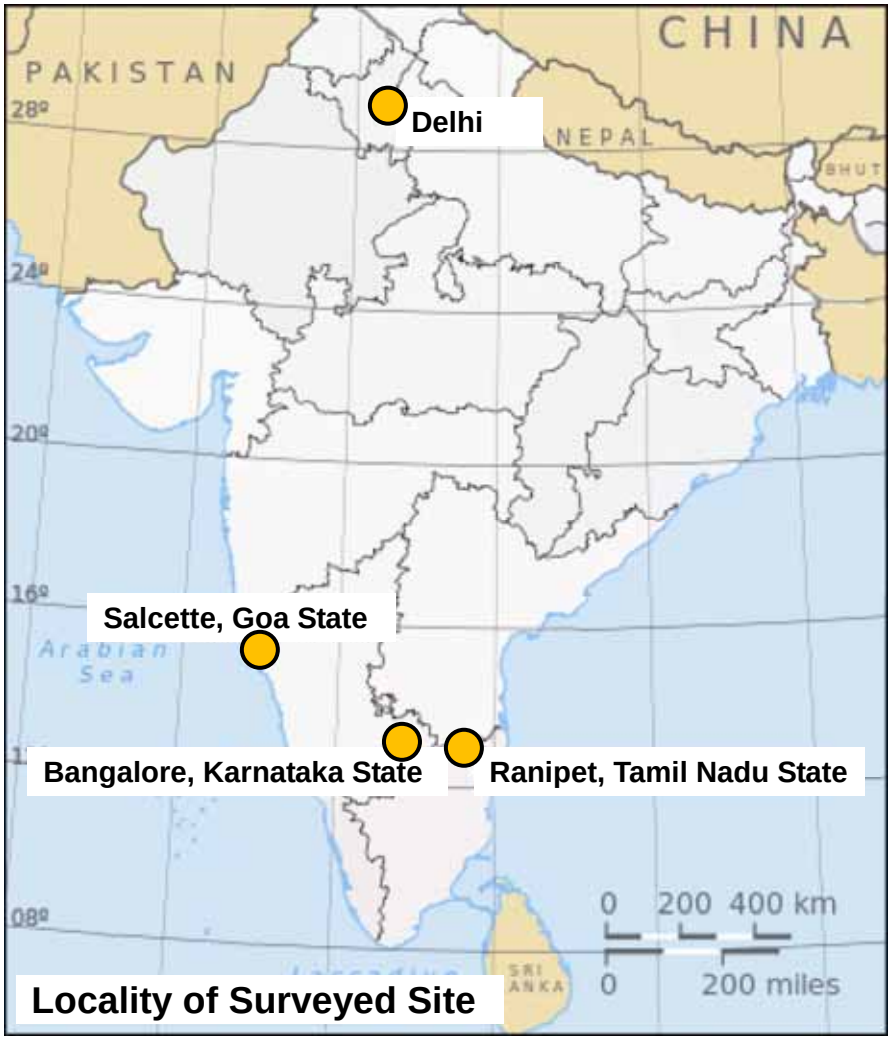
March, 2013

Joint-Venture Group of AsahiGeo Survey Co., Ltd.

Panasonic Excel International Co., Ltd.

List of Acronyms

CPCB	Central Pollution Control Board
DEA	Department of Economic Affairs
DPCC	Delhi Pollution Control Committee
EPA	US Environmental Protection Agency
GSPCB	Goa State Pollution Control Board
JICA	Japan International Cooperation Agency
KSPCB	Karnataka State Pollution Control Board
MoEF	Ministry of Environment and Forests
NEERI	National Environmental Engineering Research Institute
NGRI	National Geophysical Research Institute
NPRPS	National Program for Rehabilitation of Polluted Sites
PPP	Polluter-Pays Principle
SME	Small and Medium Enterprises
TNPCB	Tamil Nadu State Pollution Control Board



SUMMARY

Introduction

This study confirmed requests for the ODA project formulation in relation to the remediation of groundwater pollution to secure water resources as the foundation of sustainable social development in the Republic of India. These requests were made in meetings with the Indian governmental agencies and interviews with local enterprises in four cities within the National Capital Territory of Delhi and its satellite towns, as well as in Tamil Nadu State, Raniphet, Karnataka State, Bangalore, and Goa State, Salcette.

The results were that for both the local authorities responsible for pollution cleanup and the central government controlling them, the current situation of the groundwater environment in India causing serious health damages is alarming, and there is a very serious need for groundwater remediation. Likewise, observations of the polluted sites confirmed that the extensive damage in India caused by the dumping of waste had progressed more than anticipated. The conclusion was that complex assistance including emergency measures from a humanitarian standpoint needs to be considered.

I. Description of the current situation and needs for the development issues concerned

The agency of the ODA project anticipated in this study is the Ministry of Environment & Forestry (MoEF). The MoEF upholds the remediation of the River Ganges, and the remediation of polluted derelict sites (Legacy Polluted Sites) as national missions of the 12th Five-Year Plan (April 2012 to March 2017). In the plan, regarding the cleanup of polluted derelict land related to this study, 10 sites are the current subjects for cleanup with the assistance of the World Bank. The budget for costs of the Five-Year cleanup plan is 75.39 million USD (6.86 billion yen). In addition to these 10 sites, 69 sites are known world-wide as causes of serious health damages including Ranipet (a region that is the object for this proposal). These sites are confirmed as acknowledged sites of pollution by the government. In relation to the pollution remediation, the Indian government states that it will pursue proprietors in line with the Polluter-Pays Principle (PPP). Since then, states (local governments) have conducted cleanup of lands on which no proprietors exist (orphaned sites). Thus, it is likely that, in actuality, a massive number of polluted sites exist in which serious environmental damage has occured including sites, where proprietors currently exist. Accordingly, it is clearthat the country has a great need for groundwater remediation. However, in order to achieve the project, project formulation based on the approval of the central government is essential, and to establish readiness of the central government to receive assistance, through appealing the significance of the issues with the

cooperation of the local government, is needed.

In the Indian government, the Ministry of Environment and Forestry (MoEF) is a liaison for the Department of Economic Affairs (DEA) on project formulations of human-induced pollution caused by the operations of factories. The Central Pollution Control Board (CPCB) and each state's Pollution Control Board (State PCB) belongs to the Ministry of Environment and Forestry as the lower branches. In cleanup projects controlled by the government, once pollution is detected, the National Environmental Engineering Research Institute (NEERI) investigates, manages and evaluates of the issue, while the National Geophysical Research Institute (NGRI) implements geological and groundwater studies, under the control of the Central Pollution Control Board (CPCB). The flow of the assistance and business related to groundwater remediation in India is shown in Fig. I.

II. Possible applicability of the SME's technologies and prospects for future business development

In the environmental business in India, the advance of consultants from western nations over the last 5-10 years has been remarkable. Under the control of the State PCBs, countermeasures based on the procedures of the US Environmental Protection Agency (EPA) are implemented by the demands of foreign companies in India. However, due to problems of accuracy and budget, it has been confirmed in many places that these cleanup countermeasures are not effectively implemented. Hence, for Japanese companies, latecomers to India's environmental business, it is necessary to use the countermeasures based on the Soil Contamination Countermeasures Act in Japan as well as the procedures of EPA, to differentiate themselves from western companies in India. This simultaneous usage needs to be a simulation of comprehensive study methods and saturated zones. Also, it is crucial to establish a groundwater consortium consisting of India's environmental experts, the MoEF/CPCB, all State PCBs, the NEERI and the NGRI so as to stabilize the technical level, prevent product deterioration due to cost competitiveness, and obtain more understanding from the central and local governments. Furthermore, it can be said that, from interviews with local environment related companies, the formation of a joint body led by Japan with India's local companies and western environment consulting companies will work more beneficially than an advance by an individual Japanese company. Fig. II shows the road map of the project formulation.

III. Expected development impact and effect on business development of the proposing SMEs in the Republic of India through proposed ODA projects

Observations of the polluted sites confirmed that extensive damage in India has progressed more than anticipated. It can be said that complex assistance including emergency measures from a humanitarian standpoint needs to be considered. Note that, from the study, in promotion of environmental business in India, the remediation of sites (orphaned site) controlled by the government is indispensable for gaining the government's understanding.

IV. Proposals for formulating ODA projects

In this study, the great needs to formulate a project to restore groundwater were confirmed from each State PCB, responsible for implementing pollution cleanup, and the CPCB that controls them. However, the scale of the damage far exceeds initial expectations, and it is highly likely that there are more polluted sites in which serious damage has occurred than the number recognized by the government (79 sites). Therefore, it can be said that future assistance must screen (select) sites where the projects will be conducted, and that further urgent countermeasures/preliminary studies will be needed. The ODA project formulation (groundwater environment restoration project) proposed in this study is shown in Fig. III.

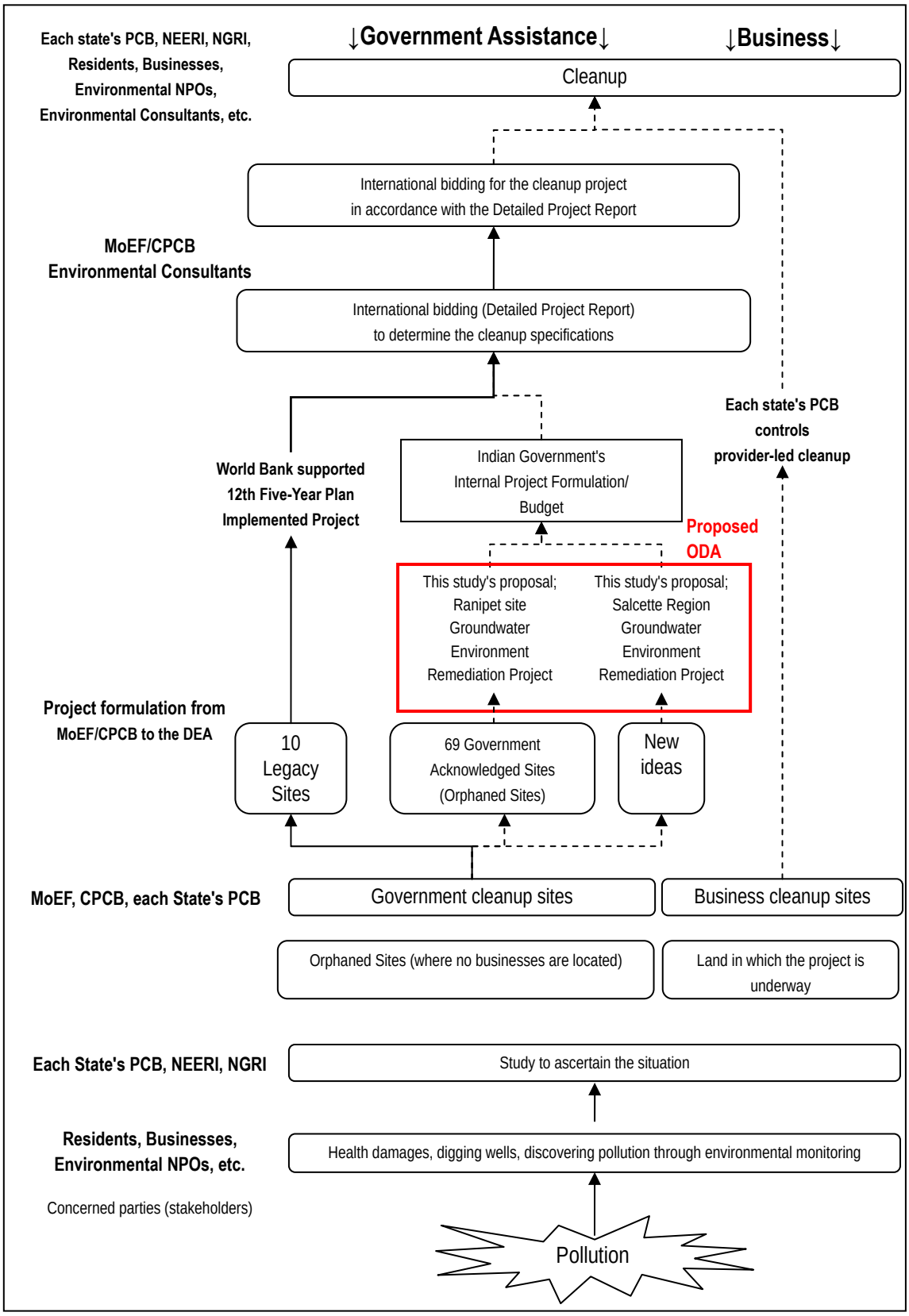


Fig. I: Flow of assistance & business related to groundwater remediation

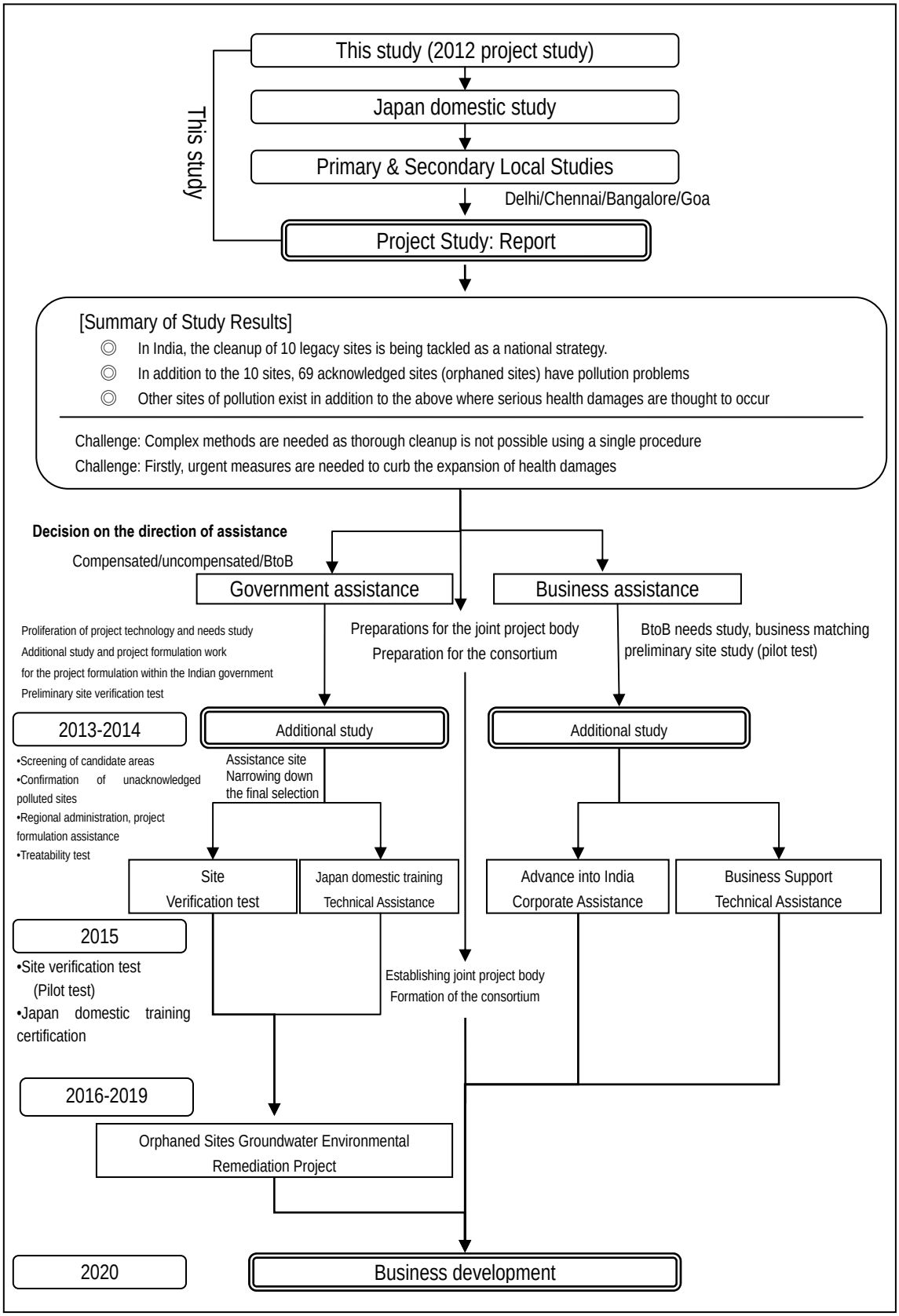


Fig. II: Road map to the project

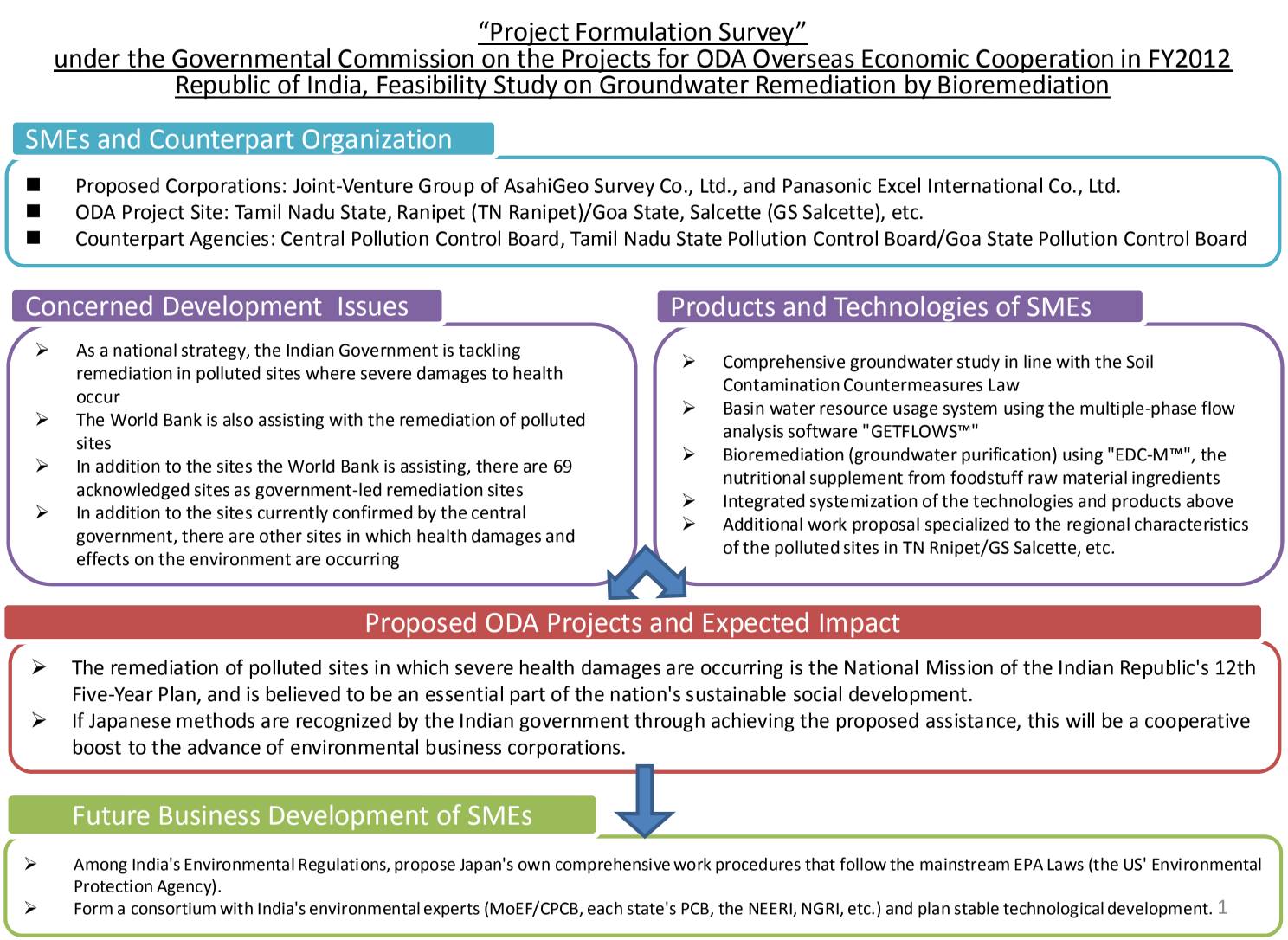


Fig. III: Proposal for the Groundwater Environment Remediation Project in India

Outline of the Survey

List of Team Members

Category	Work Responsibility	Name	Affiliation
Local Study	Party Responsible	Fumio Hotta	Asahi Geosurvey Co., Ltd
	Project Manager	Kanji Tamanushi	Panasonic Excel International Co., Ltd
	Market Survey (Civil engineering technology)	Shunsuke Kawakami	Asahi Geosurvey Co., Ltd
	Market Survey (Biotechnology)	Puchalapalli Sreenivasulu Reddy	Ecocycle Co., Ltd
	Market Survey (Biotechnology)	Shingo Maeda	Ecocycle Co., Ltd
	Market Survey (Biotechnology)	Toshiyuki Fujisawa	Ecocycle Co., Ltd
Work in Japan	Party Responsible	Fumio Hotta	Asahi Geosurvey Co., Ltd
	Project Manager	Kanji Tamanushi	Panasonic Excel International Co., Ltd
	Market Survey (Civil engineering technology)	Shunsuke Kawakami	Asahi Geosurvey Co., Ltd
	Market Survey (Biotechnology)	Puchalapalli Sreenivasulu Reddy	Ecocycle Co., Ltd
	Market Survey (Biotechnology)	Shingo Maeda	Ecocycle Co., Ltd
	Market Survey (Biotechnology)	Toshiyuki Fujisawa	Ecocycle Co., Ltd
	Head Office	Misako Mori	Panasonic Excel International Co., Ltd
	Head Office	Aya Hirano	Asahi Geosurvey Co., Ltd
	Head Office	Shigeru Uno	Panasonic Excel International Co., Ltd

Schedule

20 Nov 2012 to 10 Dec 2012 : Site survey preliminary preparation (work in Japan)
11 Dec 2012 to 21 Dec 2012 : Primary site study (site study)
22 Dec 2012 to 11 Jan 2013 : Site survey preliminary preparation (work in Japan)
12 Jan 2013 to 20 Jan 2013 : Secondary site study (site study)
21 Jan 2013 to 31 Jan 2013 : Create report (work in Japan)

Records of the Primary Site Study

Date	Agencies visited and interviewees, etc.	Study Items, etc.
12/11 (Tue)	Transit: Narita to Singapore (SQ637) Transit: Singapore to Delhi (SQ408) 24:00 Arrive at accommodation	—
12/12 (Weds)	10:45-11:30 Indian Embassy (Councilor Maeda) 14:40-15:40 E Company (local environment consultant) seminar 16:50-18:30 Blacksmith Institute (USA NPO)	•Confirmation of Study Objective/Create Letter of Introduction •Interview with local consultant •Interview with NPO related to environmental pollution
12/13 (Thurs)	9:40-11:00 Urban Development Ministry, Public Hygiene/Environmental Technology Central Agency (JICA Mr. Sakakibara) 14:20-15:50 A Company (local environmental analysis office) seminar 16:50-18:20 S Company (local boring company) seminar	•Confirmation of Study Objective/local information •Interview with local analysis company •Interview with local boring company
12/14 (Fri)	9:20-9:50 JICA India Office (Ms. Doyle) 15:40-18:30 P Company (local parts factory) seminar, visit to the company's groundwater remediation site	•Confirmation of study objective/ODA project •Purification implementation providers and visit to purification site
12/15 (Sat)	11:30-16:00 I Company (local environmental consultant) seminar	•Interview with local consultant
12/16 (Sun)	Day off	-
12/17 (Mon)	11:30-12:15 CPCB/MoEF (Chairman and 4 others) 14:20-14:50 Urban Development Ministry, Public Hygiene/Environmental Technology Central Agency (JICA Mr. Sakakibara)	•Administration Committee •Study progress report
12/18 (Tue)	Transit: Delhi to Chennai (9W0835)	-
12/19 (Weds)	13:10-14:50 T Company (local construction contractor) seminar 15:50-16:50 Chennai Japan Consulate General (Consul General Nakano and 3 others)	•Interview with local construction contractor •Confirmation of Study Objective/local information
12/20 (Thurs)	12:00-12:50 TNPCB (Chairman and 9 others) 12:50-18:00 Led by TNPCB/NEERI Visit to the Ranipet site Transit: Chennai to Singapore (SQ529)	•Administration Committee •Visit to polluted site
12/21 (Fri)	Transit: Singapore to Narita (SQ12)	—

Records of the Secondary Site Study

Date	Visit period, interviewees, etc.	Study Items, etc.
1/12 (Sat)	Transit: Narita to Singapore (SQ637) Transit: Singapore to Bangalore (SQ502) 23:30 Arrive at accommodation	—
1/13 (Sun)	8:30-18:00 Observation of outskirts of Bangalore by car	•Observation of the natural environment of the Bangalore outskirts
1/14 (Mon)	9:40-13:00 Shriram Institute for Industrial Research(SIIR；NPO environmental analysis office) seminar 13:00-17:50 Observation of urban Bangalore by car	•Interview with local analysis company •Observation of the environment of Bangalore city
1/15 (Tue)	9:20-9:40 Bangalore visit to resident office (Director Yamamoto) 10:30-12:00 KSPCB committee, seminar (Chairman and 8 others, and 6 people from a local remediation provider) 12:50-13:30 Tour of polluted site led by KSPCB 14:00-16:00 Tour from KSPCB and remediation provider F Company visit to remediation site Transit: Bangalore to Goa (AI993)	•Confirmation of study objective •Administration Committee •Visit to remediation site
1/16 (Weds)	10:00-10:50 GSPCB committee, seminar (Chairman and 40-50 other people) 10:50-17:00 GSPCB-led tour of Sal River basin, Salcette region site 17:00-17:30 Study report to GSPCB Chairman	•Administration Committee •Visit to polluted site
1/17 (Thurs)	9:15-9:25 Introduction by GSPCB Chairman to talk with the Chief Minister of Goa State 10:25-11:35 Local ODA provider committee Transit； Goa to (Mumbai) to Delhi (AI660)	•Talk with State Representative •Local ODA provider committee
1/18 (Fri)	10:00-11:30 JICA India Project Office (Ms. Doyle, Mr. Kawamura) 13:05-13:40 PDCC committee and seminar (Chairman and 3 other people) 14:20-15:20 CPCB committee (2 officers)	•Study progress report •Administration Committee
1/19 (Sat)	10:00-12:20 Mr. Sakakibara from JICA leads tour of Delhi's urban wells Transit: Delhi to Singapore (SQ407)	•Tour of Delhi's history and wells
1/20 (Sun)	Transit: Singapore to Delhi (SQ12)	—

Photo: Ranipet site

"Ranipet" site, one of 69 orphaned polluted sites acknowledged by the Indian government (Central Pollution Board's). Polluted sludge containing chromium (the dark gray section in the photo) has been dumped to a depth of 2-4m over 30,000 m^2 of abandoned industrial land. The spring in the foreground of the photo exhibits chrome yellow containing chromium several hundred to several thousand times the standard.

Situation of a residential area 1km south of the "Ranipet" site. The well-water is not deemed potable under the directions of the administration. The well-water still exhibits chrome yellow and chromium several hundred to several thousand times the standard is detected. Many residents on the outskirts of the site are involved with the leather industry, and they practice tannage using chromium sulfate.

Photo: Goa, Salcette Region

Situation of an industrial district in the Sal River basin in the Salcette region; observed at the request of the Goa State Pollution Control Board (GSPCB). Sludge from the refining of zinc has been filled into a hole bored by a landslip, and rainwater carries exuded harmful substances as far as the Sal River.

Situation of the basin source of the Sal River; observed at the request of the Goa State Pollution Control Board (GSPCB). The river water is remarkably contaminated due to domestic wastewater from the local residential area. Pollution of the river is obviously contaminated due to domestic wastewater in the mid-to-upstream Sal River and downstream waste landfill from the industrial district that exudes toxic substances.

Photo: Polluted site observed in the Delhi suburbs

Site of groundwater remediation in the Delhi suburb. The remediation is implemented by a corporation handling chromium. The pollution has spread beyond the factory premises, and countermeasures to pump the polluted water are underway. In the right of the photo, polluted water pumped from the pumping well is conveyed to the treatment plant from the pipeline on the left.

A well has been constructed on the same premises as in the photo above. Since the well and a chromium countermeasure well are just around 10m apart, the effect of chromium is concerned. However, it is currently in use even though the usage of the well is unclear.

Photo: Polluted site observed in Bangalore

Chromium sub-soaked tanks in the groundwater pollution sites of Bangalore city. This plant manufactures heavy components and is still in operation. Health damages are feared as the sub-soaked tanks are not totally watertight, and safety protection for handlers such as masks and gloves is insufficient.

Groundwater taken from a monitored well in a polluted site within Bangalore city. The groundwater is pumped from the well near the plant in the photo above. It still exhibits chrome yellow and chromium several hundred to several thousand times the standard is detected.