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WATER SUPPLY INFRASTRUCTURE IMPROVEMENT PROJECT FOR GREATER PARAMARIBO, WANICA, PARA AND MOENGO – WASIIP

Report D1-3 - Environmental and Social Impacts Assessment – Revised Final Report

Districts of Suriname

BRL Ingénierie

Table of contents

List of Figures and Tables

Accronyms

AFD	French Development Agency (Agence Française de Développement)
DC	District Commissioner
DOG	Department of Public Health (Dienst Openbare Gezondheid)
DWV	Department of Water Supply, Minsitry of NH (Dienst Watervoorziening)
EBS	Energiebedrijven Suriname
EIA	Environmental Impact Assessment
EM(M)P	Environmental Management (and Monitoring) Plan
ESIA	Environmental and Social impact Assessment
GoS	Government of Suriname
GPA	Ground Water protection Area according Drinking Water Act
HACAS	Hydrological Assessment of the Coastal Aquifers in Suriname
Ministry OW	Ministry of Public Works (Openbare Werken)
Ministry NH	Ministry of Natural Resources (Natuurlijke Hulpbronnen)
NIMOS	National Institute for Environmental Research of Suriname (Nationaal Instituut voor Milieu Onderzoek Suriname)
NMA	National Environmental Authority
RAMSAR	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
RO-plant	Reverse osmosis WTP
WaSIIP	Water Supply Infrastructure Improvement Project for Greater Paramaribo, Wanica, Para and Moengo
WHO	World Health Organization
WTP	Water Treatment Plant

1. Introduction

As Part of the *Water Supply Infrastructure Improvement Project for Greater Paramaribo, Wanica, Para and Moengo*, in May 2017, a contract was signed between N.V. Surinaamsche Waterleiding Maatschappij (SWM), the Client and main water service operator of Suriname, and BRL Ingénierie (BRLi) for the *"preparation of technical specifications, assistance with the tendering process, works supervision and capacity building activities",* further on called 'the project'.

In 2018 an ESIA report was submitted to NIMOS and approved for the following project components, aiming at the improvement of water supply facilities & service delivery in the Greater Paramaribo and Moengo areas.

The project is funded by a loan from the French Development Agency (Agence Française de Développement (AFD) with a grant contribution from the European Commission (Caribbean Investment Facility – CIF).

The **original scope** of the project relevant to the ESIA report of 2018 are the project Parts 1 and 3.

Part 1 *of the Project (Works)* is divided into three components:

- Component 1 - Capacity expansion of Van Hattemweg wells and water treatment plant (district Wanica);
- Component 2 - SCADA system for Greater Paramaribo**;**
- Component 3 - Replacement of the Moengo water treatment plant including a new location for the raw water intake along the Cottica River and network extension (district Marowijne);

Part 3 *of the Project (Study)*:

- Component 4 - Feasibility Study for Water Supply in the district Commewijne**.**

After being suspended in 2020 by the financiers, the project was restarted in 2024 with a reduced overall scope. In the current scope, Component 2 of Part 1 (SCADA) and Part 3 (Commewijne) are no longer being implemented and will not be described in this revised ESIA report. Also, the selection and scope of works in villages surrounding Moengo has changed in comparison to 2018.

The current scope of the project consists of the following:

1 Component 1: Rehabilitation of the existing 1,000 m^3/h Water Treatment Plant (WTP) in Van Hattemweg (Wanica District) owned and operated by SWM;
2 Component 2: Construction of a new 200 m^3/h compact Water Treatment Plant (WTP) in Moengo Town (Marowijne District) and ancillary works (water network reinforcements in Moengo Town and water supply improvement works in four (4) neighbouring villages). The new Moengo WTP will be owned and operated by SWM.

SWM is the Executing Agency and the Components 1 and 2 will be implemented through a design and build tender. BRLi has been contracted by SWM to act as the Engineer for the Project.

This *Environmental and Social Impacts Assessment describes f*or Components 1 and 2 (previously Component 3) the main associated Environmental and Social issues, and the legal requirements.

2. Objectives and Scope

The financing of the implementation and construction of the overall project is subject to approval by the AFD. As a standard procedure AFD needs to be fully informed about possible secondary impacts the project might have on the surroundings and or on social issues, wellbeing and health.

The objective of underlying report is to describe possible environmental and social impacts related to the construction and operation of the two earlier mentioned components of the project.

The report highlights all the relevant environmental and social aspects and when necessary, presents recommendations for improvement, that can be taken into consideration for final designs, site selection, construction and operation of the new systems.

The information for this report was obtained through field visits of the Environmental and Social Impact experts to the involved project locations, through interviews with environmental authorities and with SWM-experts, with the BRLi project team and was further completed by own investigation and literature and Internet searches.

The detailed descriptions of the processes, drawings of the sites and figures on water quality and cost calculations are not repeated in this report but can be found in the BRLi technical project documents namely:

- D1-1 Inception Report (final version July 2017);
- Technical notes submitted to SWM over the first 6 months of the project;
- D1-2 Report (draft version submitted mid-December 2017);
- D1-2 Report (final version submitted in September 2018);
- WaSIIP Project Rescoping Report (final version submitted in September 2023);
- WaSIIP Project Restart – December 2024 Mission Report (final version submitted in January 2025);
- Monthly Progress Reports and Minutes of Meetings.

3. Organizational Aspects and the Environmental Legal Framework of Suriname

3.1 INSTITUTIONAL SET-UP

Regarding drinking water supply, infrastructural works and environment, the following competent authorities are of importance:

- Suriname Water Company, or *N.V. Surinaamsche Waterleiding Maatschappij* (SWM) is Suriname's national drinking water service operator, and responsible for drinking water and ground water policy. SWM is a limited liability firm with the Government of Suriname (GoS) as its only shareholder, and resides under the Ministry of Natural resources (see below). SWM facilities supply water to Paramaribo and most locations in the coastal area, as well as selected interior communities. SWM has a laboratory that monitors the physical, chemical and microbiological quality of the water and tests it against (inter)national quality standards based on measurements and observations.

- *Ministry of Natural Resources (Ministry NH)* and more in particular the Water Department (*Directoraat Water*), is responsible for drinking water policy and integral water management. The Water Department consists of the sub-directorate water (*Onderdirectoraat Water* -ODW) –which incorporates the Water Supply Service (*Dienst Watervo*orziening -DWV), and the section Integral Water Management (*Integraal Water Beheer* -IWB). The Water Supply Service (DWV) is jointly with SWM responsible for drinking water supply, whereby the DWV is specifically involved in the case of drinking water supply to interior communities. DWV also extends concessions for water extraction

- *Office for Public Health (BOG).* This department of the Ministry of Health is a national institute for monitoring and promoting general public health. The BOG performs independent control of drinking water quality, and assesses health aspects. Control of the quality finds place through its Laboratory (Central Lab).

- *Ministry of Public Works (OW).* This Ministry is responsible for infrastructural aspects including pipeline locations and associated excavation and construction works. The Ministry of OW has shared responsibility for surface water (with NH and the Ministry of Agriculture, Livestock farming and Fishing).

- *Ministry of Spatial Planning and the Environment* (ROM)

  In July 2020, the institutional structure for environmental management changed with the change of Government. The structural change included the establishment of a Ministry for Spatial Planning and Environment (ROM). The Ministry of ROM aims to coordinate all environmental activities in the country. Legal positioning of the Ministry of ROM became a priority of the Government, and a formal working group was established for amending the Environmental Framework Act. The amendment proposes the Ministry to become primarily responsible for coordinating Environmental Policy while the NIMOS was transformed into the National Environmental Authority (NMA).

- *National Environmental Authority (NMA),* launched at July 26, 2024, is Suriname's national environmental protection agency. The Ministry of Spatial Planning and Environment (ROM) is responsible for environmental policy, while NMA serves as their working arm. The NMA advises on environmental policies and legal issues for all Ministries and is responsible for EIA screening and the evaluation of EIA reports. The NMA is the successor of the National Institute for Environment and Development in Suriname (NIMOS) and has more legal powers than NIMOS had regarding permitting, inspection and enforcement. The NMA is currently in the process of setting up the permitting processes and inspection tasks. The permitting system is not yet operational. However, NMA is the authority that needs to be informed of new plans and their environmental and social effects as from the start of the project. Therefore, SWM has formally informed NMA about the foreseen project activities and has requested NMA to revise this report

- *District Commissioners (DC)* of the involved districts Wanica, and Marowijne Southwest (see map on page 1). The DC is the highest authority in each District of Suriname. In relation to this project the DC is responsible for the issuing of permits under the Hindrance Act (Hinderwet).

3.2 LEGAL FRAMEWORK

Applicable legislation and standards

In March 2020, the 'Environmental Framework Act (EFA S.B. 2020 no. 97 (Dutch: Milieu Raamwet) was approved by the Parliament, published in the Gazette in May 2020 and amended in May 2024. The EFA aims to protect and elevate sustainable management of the environment in

Suriname. The Act establishes the National Environment Authority (NMA) as a statutory body responsible for the implementation and enforcement of this law.

The EFA is still a Framework Act, defining procedures and responsibilities but not yet equipped with clear standards and permit requirements.

For the EFA to be operational, a set of subsidiary legislation will need to be promulgated, most of which is already in draft form (see below), but is unknown when this will become in force:

- The Duty of Care, whereby every citizen has a general duty of care regarding the environment, including refraining from acts or omissions that have adverse consequences for the environment.
- Environmental and Social Impact Assessment. Although the EIA process has been administered by NIMOS since 2005, with the promulgation of the EFA it becomes mandatory. EIA regulations have been drafted and will immediately take effect after its promulgation.
- Pollution and Standards. Environmental norms and standards will be developed under the EFA. This will be executed through implementation regulations. This includes the application of environmental permits and the rehabilitation of affected areas. The pollution regulations standardize the determination of contaminants, Maximum Allowable Concentration (MAC) values for the release of contaminants, and procedures for the rehabilitation of contaminated areas. Pollution regulations have already been drafted. SWM will have to apply for an environmental permit when these regulations are promulgated. Basic reference standards for discharges to surface water are used from World bank, see Annex 2.
- Waste and Hazardous Substances and Emergency Plans. The NMA will determine norms and procedures for handling of waste (collection, transportation, storage, and disposal) and may, among other things, prohibit the import or export of any waste. Furthermore, the NMA can prohibit hazardous substances or impose procedures for import, export, safe storage, handling, transport, use and disposal. These procedures are part of a permit for hazardous substances.
- Environmental Audits. The EFA provides for the establishment of guidelines and procedures for conducting an audit. These Guidelines had not been prepared as of this writing.

The *Hindrance Act (Hinderwet)* remains in force. This Act regulates the local issues of plants and process installation as it comes to direct nuisance in the form of noise, smell etc. for the population in the direct vicinity of plants or waterworks.

In addition, there are several government policies that concern sustainable development and biological resources.

Environmental Impact Assessment

The National Environmental Authority is responsible for monitoring Environmental and Social Impact Assessment (ESIA) processes. ESIA guidelines are in place, which have been updated in the Guidance Note NIMOS Environmental Assessment Process (2023)(Dutch: Richtlijnen voor Milieu Effecten Analyse, Algemene Richtlijnen, December 2023). These guidelines include a list of processes and industries for which EIA screening applies.

Per listed industry or process, three categories have been defined, mainly based on the size and production capacity of the planned activity.: Article 22 of the EFA defines that NMA decides for which activities which level of Environmental Impact Analysis is required, and which information needs to be provided for evaluation:

- Category A: a full EIA is required;
- Category B: to be decided by NMA whether full EIA or an EIA Statement is required and possibly additional documents;
- Category C: no further information needs to be provided for these activities.

The waterworks and treatment plants subject to this project are listed in these Guidelines under Category B, Path 2, meaning a concise Impact Assessment in the form of an EMP.

For discharge of wastewater to surface waters the reference World Bank standards, as published by NIMOS, are applicable.

3.3 EIA PROCESS AND NMA SCREENING DECISION

On February 17th,2025, SWM sent a formal request regarding EIA obligations to NMA along with a description of the scope of the project.

In its answer, NMA has indicated that for this SWM project is a category B path 2 process applies: a concise EIA in the form of an EMMP with annexes. This ESIA report forms an annex to the EMMP.

4. PART 1 – WORKS PREPARATION AND SUPERVISION

4.1 COMPONENT 1- VAN HATTEMWEG

4.1.1 Scope

This component includes:

- The rehabilitation of the existing WTP at Van Hattemweg using the same treatment process: Rehabilitation of the filter building, rehabilitation of the sand filters and shell filters, rehabilitation of valves and appurtenances, change defective backwash and effluent pumps, install instrumentation and SCADA for plant automation, install temporary compact by-pass plant in containers (25% to 50% current plant capacity with pressure sand filters and lime injection) to limit supply disruptions during the rehabilitation works. The current plant capacity of 1,000 m3/h will remain unchanged; a new diesel genset will replace the existing one (identical capacity, 1,000 KVA).
- The installation of a flow meter and an aeration tower directly upstream of the existing sand filters. As a result, the emissions of H_2S and CH_4 released during aeration, will take place outside of the main building and will no longer impact the health of workers in the filtration building.

4.1.2 Environmental Baseline

At present SWM operates a WTP at Van Hattemweg (Figure 1) with a capacity of 1,000m^3/h. The plant is fed by eleven deep groundwater wells which are located along the Van Hattemweg road,

right next to the road with a distance of about 400 meters between each well. Ground water is pumped to the station and is treated inside a building by gravity sand and shell filters (Figure 2).

Figure 1. Exsting WTP building

Figure 2. Sprinkler installation on gravity sand filters.

Within the building the water is sprayed first over the 5 sand filters with sprinklers and trickles down by gravity to the two shell filters. The spraying system serves as oxygenation and removes the gas components in the water, H_2S and Methane mainly.

The sand and shell filters in the building are backwashed by reverse current of air and water. Sand filters are backwashed every 24h, shell filters are backwashed once every 2 months. This results in approximately 1,300m^3/day of process water for the sand filters and approx. 1,300m^3 per 2 months for the shell filters. These amounts form about 3-5% of the total water flow, which is a standard amount for this kind of filter cleaning procedures in drinking water plants.
Figure 3 shows the water treatment process at Van Hattemweg.

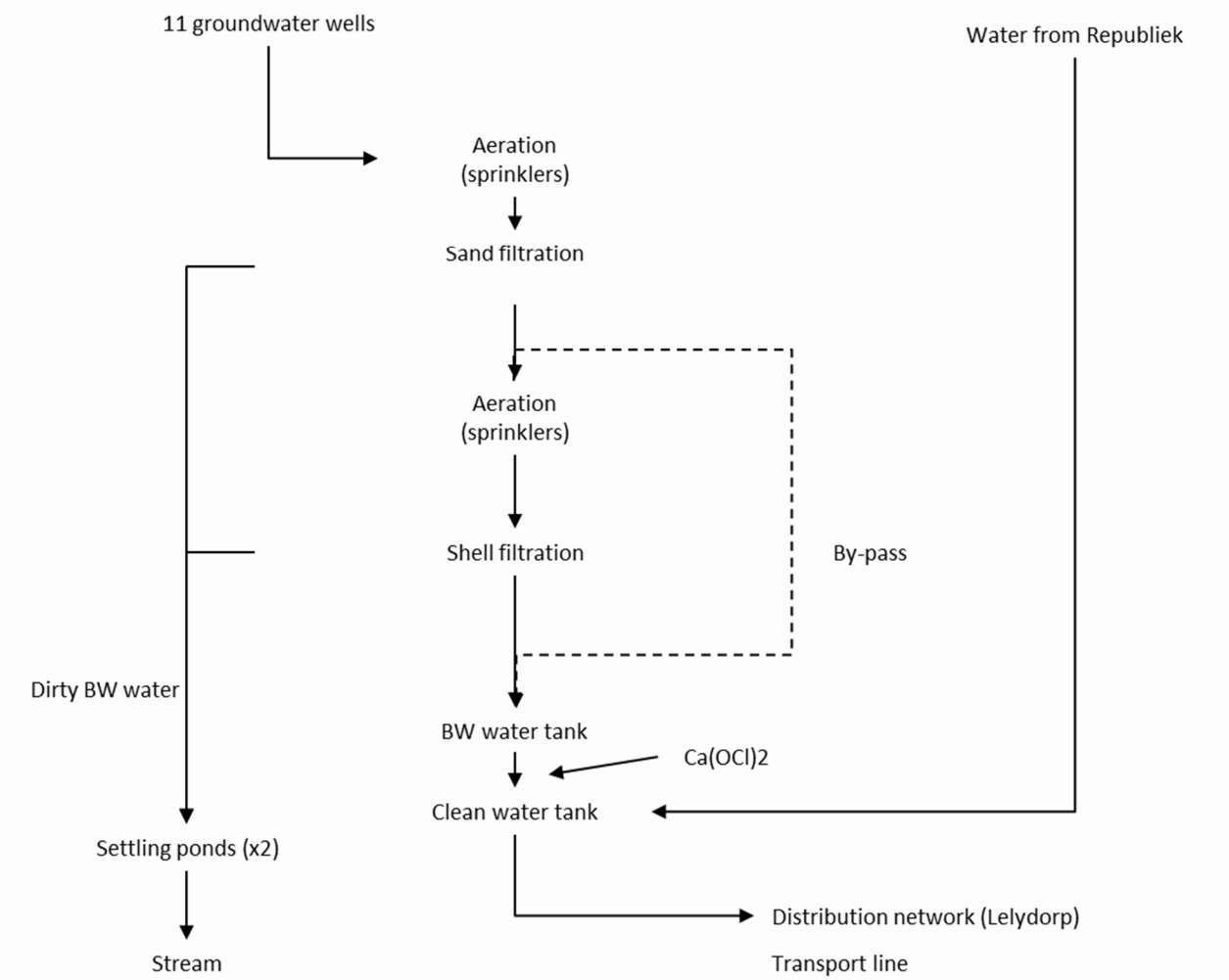


Figure 3. Schematic outline of the existing drinking water treatment process at Van Hattemweg

The backwash water contains mainly sand from the filters and Ferro- and Manganese oxides, formed during the oxygenation process of the ground water. The process backwash water is discharged into a sedimentation ditch/pond on the premises of SWM

The treated drinking water is stored in clean water underground reservoirs before it is pumped into the transmission and distribution pipelines for consumption in Wanica and Paramaribo.

A small chlorination unit is present at the location for occasional use in case of detected bacteriological contamination in the drinking water

At the location, a genset with diesel tank is installed for back-up energy, in case of power cuts. The genset does not perform well and is not operational. The existing diesel tank is well installed in a secondary containment pit, thus not forming a threat to the environment in case of leakage or accidental spills.

<u>The main environmental aspects with respect to the existing situation are:</u>

- H_2S (acidifying gas) and Methane (a GHG, contributing 25 times more to global warming than CO_2) are emitted freely in the WTP's main building and are dispersed to the atmosphere by natural ventilation;
- These gases are formed in small quantities but due to poor ventilation they form rather high concentrations within the building, which can be considered harmful from an occupational safety point of view. No detection devices are present to warn workers for excessive concentrations;
- Corrosion is a problem in the WTP building, due to the emission of acid gasses much of the steel construction is seriously affected;
- Emissions to the atmosphere of CH_4 and H_2S might contribute to odours in the near vicinity of the plant, although no complaints were received over the past years. Concentrations and quantities are low and no nuisance is expected in the future situation as well;
- The chlorination unit is installed in a secondary containment (Figure 4), not forming a direct hazard to the environment, but from occupational health point of view the unit should be less accessible and should be fenced;

Figure 4. Small chlorination unit at Van Hattemweg

Figure 5. Sludge ditch/pond at Van Hattemweg

-The sedimentation ditch/pond (Figure 5) for the backwash water and sludge is in very poor conditions and is no longer impermeable, causing leakage to the subsoil;
-The cleared water at the top layer of the ditch, still containing high concentrations of suspended solids, is discharged continuously into a small canal connected to other surface waters;
-Although not considered harmful, the manganese and ferro-oxides containing sludge are removed periodically from the bottom of the ditch to be deposited on land and in the same area;
-The same applies to the used sand from the filters. The sand is renewed once a year. The used sand is dumped on site. The volumes are low, and no hazardous components are present in this sand;
-About 2 kilometres SSW of the Van Hattemweg extraction locations there is an old spoil area of Suralco mining activities (Figure 6). The location contains removed material from ground works, dating back to the very beginning of Suralco's activities (around 1965). The location is now in use as a residential area (since 1969). The deposited material in principle is not harmful because it consists of the natural topsoils that were removed before mining started. SWM has been extracting water from the Van Hattemweg boreholes since a very long time reportedly without problems of contamination of its groundwater wells, although, sporadic pollutions have been revealed by past water quality analysis (aluminium, lead). It is recommended that SWM includes these potential pollutants in the monitoring and measurement program for soil quality in the vicinity of the water wells. Aquifer contamination from the SURALCO spoil area has not been established and is not considered an immediate threat though further studies are warranted.

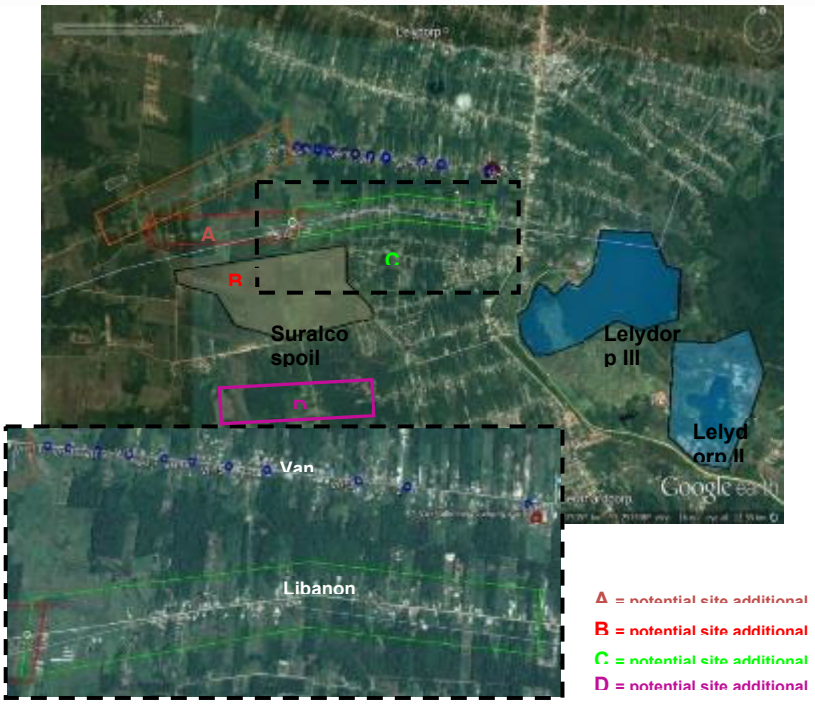


Figure 6 Location of Suralco old spoil area

-The monitoring of the intake water takes place on a regular basis;
-There is not a good register of the environmental soil quality in the area. Based on available information (Vitens report), no serious contamination of the present extraction wells was detected;
-The existing wells (Figure 7) are rather unprotected in public areas right next to the road which is a potential risk for intrusion of oil or other chemicals deposited near the well;

Figure 7. Existing Borehole at Van Hattemweg

4.1.3 Environmental Impacts of the Proposed Project

Boreholes and extraction remain unchanged as compared to existing situation

Regarding the water quality for human consumption, SWM has carried out analyses of the raw water from the aquifer. In some of the samples contaminants were measured in the exploratory well in Libanonweg (Zanderij aquifer) in 2013. The results of the laboratory test are available with SWM.
The first test indicated a too high Pb level in one sample, but further testing did not confirm these high levels. The source of the lead contamination is not known, and doubts exists whether actually lead was detected or that this was an imprecise analysis of the laboratory. Concentrations of lead in the first sample were detected above the WHO threshold of 10microgram/liter. Aluminium traces were another concern but detected levels were within the WHO limits. It is unknown where these traces of Pb and Al originate from. For aluminium it is possibly a natural phenomenon since the area is very rich in bauxite and aluminium. Former mining activities of Suralco near the Van Hattemweg might be another source. No reports or data concerning this could be identified during the study with NIMOS, SWM and other authorities.

(Also, the environmental manager of Suralco indicated that no reports are available within the company).
No soil investigation reports about the soil quality in the possible area of influence of the wells are available. Therefore, it cannot be predicted whether these traces can be expected again in the future.

Laboratories in Suriname are not well equipped for heavy metal detection and measuring. None of the labs is certified for ISO/IEC 17025:2005. FILAB is the entity that does most of the sampling and analysing for the mining sector. Most samples are sent abroad for analysis.

Impacts of the renewal of the Water Treatment Plant at Van Hattemweg

The renewal of the treatment plant at Van Hattemweg WTP will take place in the existing and additional building which will be fully revamped. The applied filter system will be the same as the existing one with sand and shell filters by gravity filtering**.** The construction works of the new plant will have no significant environmental impacts as long as standard practices for excavating and disposal of construction waste will be followed (separation, recycling, controlled dumping). Some noise and extra truck movements will be inevitable but given the size of the works this will be insignificant from an environmental point of view and only for a short period.

*Figure 8. Location of the aeration tower, next to the main filter buildi**ng***

Figure 9. Pressure sand filters at WK-plein in Paramaribo

The impacts on natural surroundings and aesthetics will be insignificant, since the same location and building will be used (Figure 8).

For the new situation the aeration system will be installed in a tower next to the existing filter house, before the water enters the filters (Figure 9). The problem of high H_2S and CH_4 concentrations within the new building will therefore not occur, leading to a safer working environment for the operators. The total emission of CH_4 and H_2S to the atmosphere will remain unchanged compared to the present situation and will remain very limited in absolute quantities.

The genset will be replaced by a new similar one, the diesel tank will remain in place. At present the generator is not working. No extension or change in comparison to the actual situation is foreseen. (As an example: the generator was used 13 days in 2016 according to SWM records at Van Hattemweg WTP). Also, the existing chlorination tank will remain unchanged.

Also, the sludge production will remain unchanged. The sludge will remain of the same content and quality as in the present situation. Although there is no legal restriction for discharging this sludge and process water into the environment, SWM operates settling reservoirs to reduce the TSS. Settling time will be around 9 hours which will be sufficient to meet the TSS standards (reference standards from World Bank 2008, as included in annex to the EMMP report).

4.1.4 Social Impacts of the Proposed Project

Social environment

The SWM plant at Van Hattemweg, known as the Productie Station van Hattemweg (PSHT), is located on an uninhabited plot of land. The plant is situated along a side road, about 50 m inside from the main road. The nearest neighbour to the left, at Van Hattemweg 43 and about 15 m from the SWM plant, is an elderly man. To the right, at Van Hattemweg 51 and about 10m from the SWM plant, lives a woman. Across the road lives a family, which also operates a beauty salon (van Hattemweg 46). Next to them is a brick factory.

Land and resource uses

The Van Hattemweg project consists of rehabilitation of the existing plant, and no land use impacts are expected. Also, no land acquisition or (forced) resettlement are foreseen.

Neighbours of the SWM plant complained that the SWM plant currently contributes to local flooding because the plant discharges water into the trenches, and the culverts have become clogged. During heavy rainfall, the trenches fail to dispose of the water. One neighbour reported

that SWM had promised to replace the culverts, but this never happened. SWM to ensure regular cleaning of the trenches and replacement of the culverts.

Employment

The Van Hattemweg project will provide short-term job opportunities during construction. No long-term job opportunities are foreseen.

Archaeological, historic and cultural sites

The national registry for archaeology lists one known pre-Columbian archaeological site in the Van Hattemweg area (SUR-106 Lelydorp : Van Hattemweg (Para) (Versteeg, 2003). Because the national registry makes use of an outdated geo-referencing system, it is difficult to assess the location of this site in relation to the proposed project activities. Given that excavation works will be limited, it is unlikely that the project will disturb archaeological resources.

Noise and vibration

The next-door neighbours of the SWM Plant at Van Hattemweg reported that they experienced no noise pollution from the current operation. A consulted neighbour across the street reported that he Is bothered by noise from the plant in the early morning, when the air blowers are in operation to backwash the filters. This produces much noise. During the rehabilitation of the plant, measurements will be done to ascertain whether noises are within or above the permissible limits. In the latter case, recommendations shall be made to install mufflers or other sound attenuation devices.

Construction activities will mostly take place at some distance from residential areas and will be temporary only.

Social benefits

The project will improve the provision of safe tap water for Paramaribo, thus benefitting a large share of the Suriname population at the national level.

4.1.5 Recommendations

Environmental

Application of an aeration tower before the filtration process will reduce occupational health risks and will lead to better dispersion of the emitted CH_4 and H_2S and CO_2 since the mission point

will be slightly higher than in the existing situation, where the gasses are freely emitted through walls and roof of the filter house.

The new filter house should be closed well so no longer birds, insects and bats can enter. These animals form a risk for the water quality e.g. coli bacteria. Windows and roof scan be closed easier anyway in the new situation since natural ventilation for the aeration gasses is no longer needed, since this will take place in the adjacent tower.

Following Dutch practices for drinking water sludge (information from AquaMinerals, entity that handles Dutch drinking water sludge for different drinking water companies), it is proposed to dewater the sludge as much as possible and to test the sludge from the reservoir periodically. Only possible arsenic content sometimes forms a bottleneck. In case arsenic content is higher than 50mg/kg it is considered chemical waste and in the case of Suriname it would be necessary to bring the sludge to Ornamibo dumpsite, which is nearby[1]. In other cases, use on land or even agricultural land is possible. However, since no good testing facilities and testing protocols are in place, it is recommended to bring the sludge to Ornamibo as a standard procedure. The quantities are low, and this will not lead to excessive costs.

It is proposed to improve the sludge reservoir by making it impermeable, with a concrete or HDPE liner (geomembrane). It is also recommended to extend the retention time of the water by adding a second reservoir. The outlet to the second reservoir can be a cascade system taking the cleanest water from the surface.

The sludge can be removed regularly from the bottom of these reservoirs and can be used for covering at the Ornambio official dumpsite[1] (which is in great need of covering sand). Although the quantities of the sludge from the WTP are rather insignificant for the dumpsite this is considered the most environmentally sound option.

The chlorination unit should be better protected for occupational safety reasons;

Prepare detailed study on movements of existing contaminants in the soil. This is a serious omission in the existing information for a good choice of extraction well locations, possibly impacting the final water quality.

[1] *Dumpsite* : uncontrolled location where waste is dumped. Not equipped with protective lining systems, covering material, leachate treatment systems gas recovery as applied in so called *Sanitary Landfills*.

Improve the monitoring practices at the intake of the WTP of the abstracted groundwater. Regular measurements are recommended at the intake[2], including laboratory analyses of heavy metals such as lead, aluminium and pesticides. According to information provided by SWM, within the Water resource management plan, upgrading of the source monitoring system is foreseen, including for heavy metals.

The environmental risks at three pumping stations need further study to get better knowledge of the impacts and use this for the final design and location of the wellfields and the measures needed to safeguard the wellfields from pollution. The protection of the wellfields against pollution is embedded in the (draft) new groundwater law (Bouterse, 2017) through the nomination of groundwater protection areas (GPA), which regulate human activities within the GPA depending on the level of pollution risk."

In case levels of heavy metals turn out a recurring problem in the area the new plant should be extended with a coagulation/flocculation and/or an ion exchange process step.

[2] Refer to D1-2 Report Section 5.5.1.3

Social

General

In cases where drilling and/or other construction activities take place closer to homes, and in cases where the road will be temporarily obstructed, area inhabitants must be notified well ahead of time (min. one month). Also, prior to the start of construction activities, a stakeholder meeting for area residents must be held to address possible concerns and plan project activities in such a way that nuisance to area inhabitants is minimized. This may include, for example, that the contractor will not execute activities that produce noise and vibration in the evening hours or during weekends.

It is advised to clear the trenches and/or replace culverts to facilitate discharge of wastewater.

Archaeology

Given the absence of Suriname national guidelines in the case of archaeological finds, the construction activities should be consistent with internationally recognized good practice as described in the ICOMOS (1990) Charter for the Protection and Management of the Archaeological Heritage. In addition, the Contractors must comply with the Government of Suriname (GoS) Monument Law of 2002 for immoveable archaeological resources found during the course of the project.

Article 20.1 stipulates that monuments found in excavations and on which no one can prove the right of ownership are owned by the state. 2. The owner of the land in which the monuments have been dug up is required to transfer the found monuments to the State and is entitled to a reimbursement amounting to half the value of those monuments. 3. Monuments found in an investigation may be transferred to a place suitable for their custody on the instructions of the Minister [of Education, Science and Culture].

Article 21. States that the finder…, within thirty working days after the discovery must indicate the exact location, time, monument and particulars of the discovery to the District Commissioner (DC) of the district in which the discovery has been made who shall immediately notify the Minister.

The SWM project activities should also comply with Stichting Bosbeheer (SBB) 2011 Code of Practice that includes a zoning standard for places of cultural importance and archaeological sites. Article 3.2 of the Code of Practice states that areas of cultural importance, settlements, fields, cultural history, spiritual and archaeological sites should be excluded (50 meters) from the exploitation area. If archaeological or cultural historical findings are made, relics and locations have to be reported immediately to [MINOWC]. The licensee and their staff, contractors or representatives will refrain from interfering in any way with such sites and / or relics. National guidelines are still in review phase by the government Directorate of Culture of the MINOWC and are not available for distribution.

4.2 COMPONENT 2- MOENGO AND SURROUNDING VILLAGES

4.2.1 Scope

This project component includes:

Moengo WTP

1. Replacement of the existing 60m3/h Moengo surface water treatment plant by a new potable water treatment plant with a capacity 200 m3/h;
2. The same technologies will be applied as in the existing plant: coagulation/flocculation decanters, sand filters and chlorination.
3. A new pressurized sand filter will be installed;
4. The new WTP will be 200 meters up-stream, also on the banks of the Cottica river;
5. A new raw water intake from the Cottica River will be about 500 meters up-stream;
6. A pipeline will be constructed from this raw water intake to the plant;
7. The old WTP will be decommissioned (conditional tranche of works, depending on availability of funds);
8. A pumping unit will be installed for filter backwashing;
9. The existing water storage tower (560m3) will no longer be used. It was decided that the existing tower will remain in place as a landmark for Moengo. The sand filters in the New WTP will be backwashed with backwash pumps instead of the water in the tower.

Moengo Town distribution

1. Replace approximately 800m of existing DN100 by DN150 between Moengo and Wonoredjo;
2. Rehabilitate approximately 500m of water network sections DN100 in Moengo;

Water distribution to villages

1. Connect with DN100 PVC pipes the New Moengo WTP to the recently laid DN 100 transmission mains supplying the 4 villages, Mora Kondre (incl. Pati Kondre), Kraboe Olo, Pelgrim Kondre, and Ovia Olo (Figure 10);

2. Improvement of existing water services in 4 villages: Ricanaumofo (about 6 kilometers north of Moengo) and Abadukondre, Benatimofo and Akalekondre (about 4 kilometers west of Moengo) by installing air valve and wash out chambers at respectively high and low points along the recently installed DN 100 transmission mains feeding the villages (to avoid air locks and facilitate water transfers and pipeline purges);
3. Installation of one or two booster stations and four (4) water towers (25 m3 to 150 m3) at Mason Town, Ovia Olo, Ricanaumofo and Abadukondre, for improved pressure and supply;
4. Supply remote villages Dantapoe and Patamaka with drinking water by water trucks (4 water trucks be purchased).

Figure 10. Project area; Moengo and originally selected surrounding villages

4.2.2 Environmental Baseline

At present SWM runs a WTP at Moengo with a capacity of 60m^3/h. The plant is located in the same building as an electricity generation plant (Figure 11). Both plants originally belonged to Suralco. This constitutes an operational risk for SWM in terms of unhindered access, ESHS (noise) and lack of knowledge/management of the port activities undertaken by Traymore NV.

And

Figure 11. Building with thermal power plant and WTP

Figure 12. Decanter at Moengo, use of AlSO4 and polymers

The water is taken from the Cottica river right next to the plant. The power plant runs on diesel and supplies electricity to the village and to the WTP. SWM counts with the concession of the Ministry of NH to extract water from the river.

The produced drinking water is pumped into the Moengo water distribution system, providing most of Moengo with clean drinking water.

Since the source of water is surface water, the WTP is equipped with a flocculation coagulation decanter unit (Figure 12), followed by a gravity sand filter system.

Some oily contamination (Figure 13) in soil and in the river near the actual intake point was detected in the past, probably resulting from accidental spills at the power station. Obvious small-scale contamination could be observed on the site. The original water intake was led by pipe from the river underneath the power plant to the WTP. After oil leakage was detected, a bypass was installed around the power plant to prevent intrusion in the pipes underneath the building. Also, the water intake in the river was lowered, so no longer water from the surface (with floating oil) was pumped in. The oil contamination was not detected anymore after these measures were implemented.

Figure 13. Evident oil spills at power plant

About 5 kilometres south of the plant and about 3 kilometres east of the Cottica river is a small uncontrolled waste dump (see figure below). No figures and studies are available but given the distance from the WTP and the distance to the Cottica river there is no reason to assume that leakage from this dump might negatively impact the water qualities at the intake.

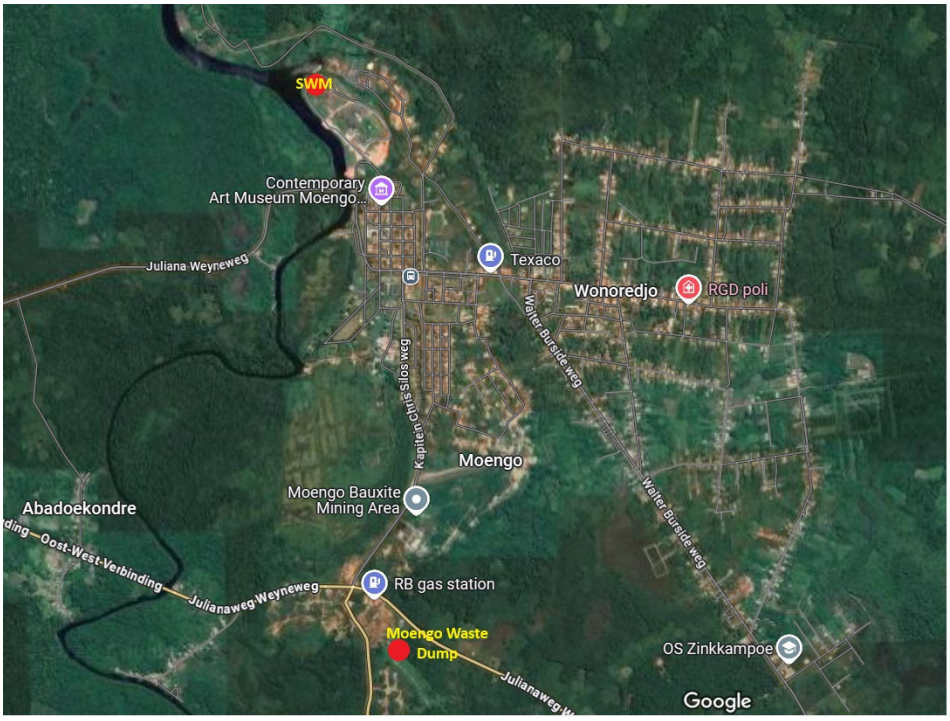


Figure 14 Location of the Moengo waste dump and the SWM plant

Run off from former Suralco activities and harbour activities at Traymore, where Cyanide materials are shipped are located downstream of the water intake point. The Cottica River shows an alternating flow directions, changing every 6 hours. In the event of calamities with Cyanide spills in combination with a reverse flow in the river, direct communication with SWM takes place to stop water intake on time as part of the existing control measures. Other calamities such as

the presence of faecal matter from livestock or leaking septic tanks will form a risk for the water intake which must be mitigated by existing and improved warning systems. This will not change in the new situation. BRLi has taken only one grab sample of raw water. No harmful elements were detected above the WHO threshold levels but the current knowledge of Cottica River's water quality should be supplemented with SWM's 12 months water quality analysis campaign.

Tidal effects in the Cottica river exist and the river flow changes due to these influences, however, no salt intrusion takes place.

The filters of the WTP are cleaned daily by backwashing. This process water amounts to about 5-6% of the drinking water production. The actual storage water tower of 560m^3 is used for the backwashing process.

The resulting backwash waters contain sludge with traces of coagulation-flocculation materials such as $AlSO_4$ and polymers, some natural sediments and some organic material originating from the river. Also, the manganese- and ferro-oxides removed from the drinking water are present in the sludge. The sludge is discharged without further treatment back into the Cottica river. This is common practice, and no adverse impacts are expected for the aquatic ecosystem. However, in the future situation it is recommended however to dry the sludge and deposit on land.

A small chlorination unit is present within the WTP building. This unit is not very safe from an occupational health point of view.

Current water use in the beneficiary villages is described in section 4.2.3.2. and Table 2

4.2.3 Environmental Impacts of the Proposed Project

<u>New WTP plant and river water intake at Moengo</u>

The construction works of the new plant will have no significant environmental impacts as long as standard practices for excavating and disposal of construction waste will be followed (separation, recycling, controlled dumping). Some noise and extra truck movements will be inevitable but given the size of the works this will be insignificant from an environmental point of view and only for a short period.

The discharge of sludge from the WWTP operation into the Cottica river, containing manganese- and ferro-oxides together with traces of polymers and AlSO4 will not lead to any significant environmental impacts to the river and no legal standards restrict the discharge to the river. A settling time of 4,5 hours will be applied, which will be sufficient to meet the TSS discharge standards (reference standards from World Bank 2008, as included in annex to the EMMP report). However, for a new installation the most environmentally friendly practices should be applied. Depositing of the sludge on land in an official dumpsite or possible future sanitary landfill is therefore recommended.

The old WTP plant at Moengo will be decommissioned and as an option it will be dismantled. In the new situation the storage tower will no longer be in use and will be replaced by a pump unit for backwashing. It is not yet clear whether this tower will be demolished (as an option, after assessment of its structural integrity) or will remain as a landmark. SWM will make that decision based on structural integrity assessment and budgetary constraints. In case of tower demolishing, the metal scrap should be recycled and other waste streams must be reused or must be brought to the dumpsite. Some truck movements and extra noise will occur, but this will be temporarily and of no significant magnitude.

The new WTP at Moengo will have a capacity of 200m3/h and will be based on the same technology as the existing plant: coagulation/flocculation decanters but equipped with pressure filters instead of the existing gravity sand filters and a chlorination unit will remain in place. The new plant will be located some 200 meters up-stream on the banks of the Cottica River and the new water intake will be around 500 meters up stream. This location will provide a longer reaction time in the event of spills at the harbour in combination with a reverse river flow situation (tidal effect).

The premises of SWM need to be extended for the construction of the new plant. A road that presently crosses the new area needs to be closed and a new road around the premises needs to be constructed. Direct access to the riverbank needs to be obtained.

The extended water intake for the new plant will have no negative effects on the flow of the Cottica river this is a large river, and the intake will be insignificant as compared to the total flow.

Noise production from the generators, and the distribution pumps will be similar as in the existing situation. No direct neighbours are there.

Distribution system to Moengo and surrounding villages

The produced water will be distributed to the town of Moengo through the existing pipeline systems. This will have no further environmental impacts. The condition of these mains must be assessed (see recommendations).

Four villages (Ricanaumofo, Abadukondre, Benati Mofo, Akale Kondre) have been connected by underground pipelines. These new pipelines were installed by SWM in 2020/2021 on the verge of the existing roads (sections of which are not tarmacked). Pipelines have also been laid to connect the villages around Mason Town (Mora Kondre, Kraboe Olo, Pelgrim Kondre), Ovia Olo, and surrounding kampus but water is currently not reaching these villages due to insufficient supply capacity/pressure. In future, after commissioning of the New Moengo WTP and ancillary pipeline works (a few extensions and installation of air valves and wash outs along mains laid in 2020/2021), the latter villages will be receiving a pipeborne water supply. A booster is currently under construction by SWM at the outskirts of Moengo, along the highway, to boost water supply to Mason Town (and surrounding village) and Ovia Olo. In future, after extension of the pipeline further south to Patamacca (not part of the scope of this project), another booster will be required just south of Ovia Olo to boost water to Patamacca.
These works will have no significant environmental impacts as long as standard practices for excavation and covering will be followed and produced waste will be collected and deposited at the dumpsite. There are no specific protected areas or locations of particular high natural interest along the planned pipeline sections. Therefore, no negative environmental impacts are foreseen with respect to the pipelines.

The most serious environmental/health risk associated with distribution networks is the maintenance of adequate pressure to protect water quality in the system in order to prevent any intrusion of possible contaminants, e.g. from septic tanks.

The booster stations will consist of 1 + 1 in line pumps (1 in operation + 1 in standby) with variable speed drives and control panels and will be powered by the electrical grid (optionally: power back up with solar panels and batteries). The pumps will cause noise in the surroundings but are located next to the main road with no houses nearby.

Also, up to four water towers (to ensure security of water supply to the villages in the event of WTP supply interruption or pipeline repair/maintenance works) with height of approximately 20m will be constructed at the following locations:

- Ricanaumofo (150 m^3)
- Abadukondre/Benatimofo (50m^3)
- Mason Town (50 m^3)
- Ovia Olo (25 m^3)

The construction of these towers will have some minor environmental impacts due to construction noise and truck movements. Once installed the towers will have an impact on the horizon and the natural habitat as a tall construction right next to the main road. As previously mentioned, the towers will have an altitude of approximately 20 meters.

The following pictures gives an impression of the Water Towers and Booster Skids to be installed.

Figure 15. Example of a Water Tower

Figure 16. Example of a Booster Skid (to be placed inside building)

Separate systems in remote villages

For the remote villages not part of this project and not yet receiving SWM pipe borne water, water supply alternatives are presented here below:

The three options are: rainwater harvesting at household level; stand-alone slow sand filtering of river water and the provision of water by truck will have basically only positive effects for the villages. The choice for the systems will be based on economic parameters mainly. None of the above systems will have negative impact on the environment, except for minor construction works and some occasional truck movements.

Stand-alone systems using river water, through slow sand filtration will produce water of an acceptable quality and will ensure a continuous water supply (as compared to the seasonal rainwater harvesting) but have the following drawbacks:

- The colour of the water will not be attractive for consumption since it will still contain a high concentration of suspended solids;
- The filters need maintenance, which will be difficult to provide at village level.

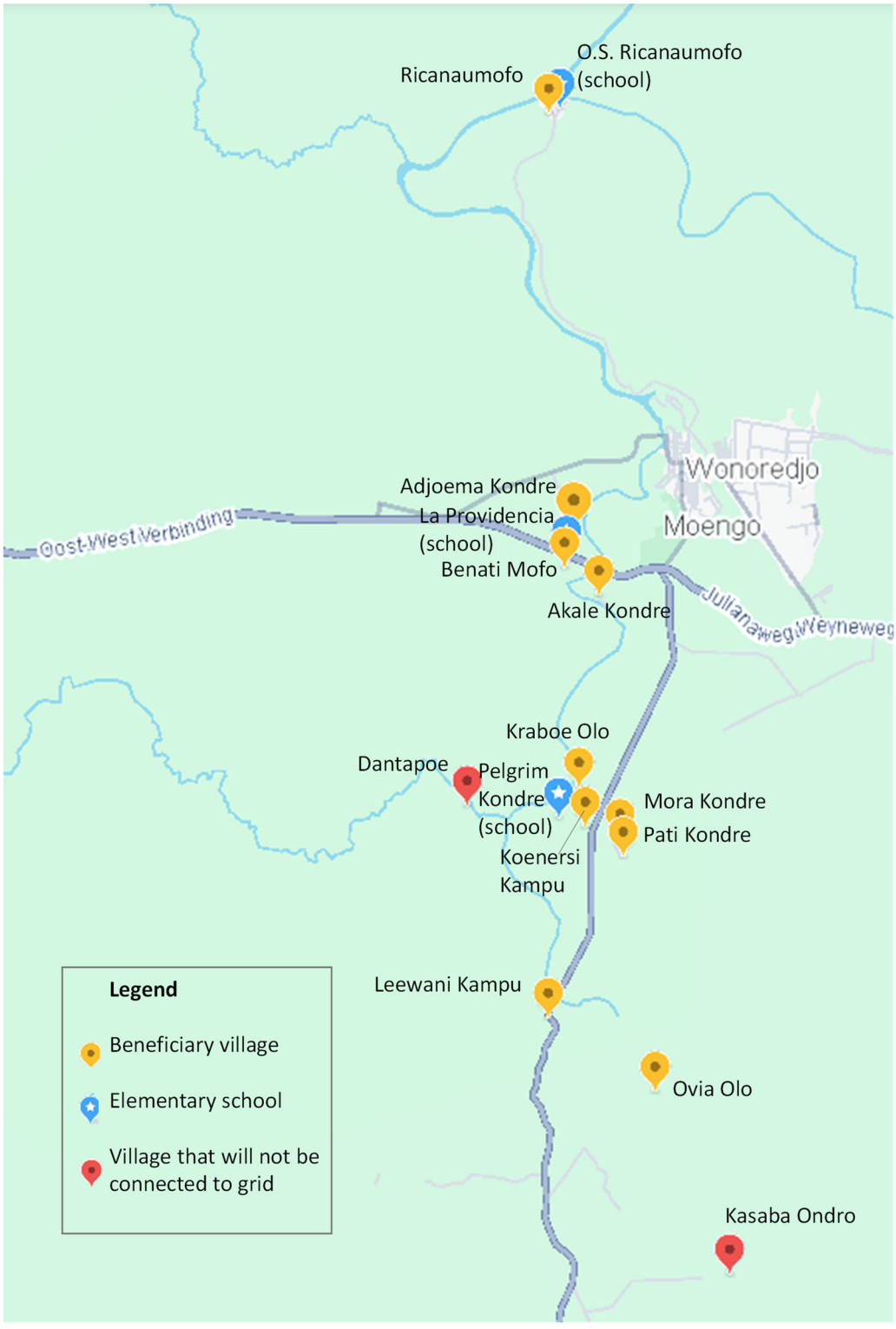
4.2.4 Social Baseline

4.2.4.1 General sociocultural background

The new WTP location in Moengo is not a residential area, with the nearest household living at about 140 m from the selected WTP location. Within 250 m from the plant, there are about 25 houses. Two elementary schools are located within 500m of the WTP area: the Fred Murray school and the St. Theresia school (between Abraham Crijnssenlaan and Gouveneur Lelystraat). There is also a church in this same area.

All beneficiary villages (Figure 17) apart from Pelgrim Kondre and Patamacca are traditional Cottica Ndyuka Maroon communities. Maroons are the descendants of run-away African enslaved people, who established independent communities in the rainforest. They are recognized as tribal people, featuring their own languages, religion, leadership structure, social organization, and other traditional cultural expressions. The Ndyuka Maroons are one of Suriname's six Maroon tribal groups. The Cottica Ndyuka are a sub-group of the Ndyuka who, in the 19th century, moved from their ancestral tribal lands along the Tapanahoni River in south-Suriname to the Cottica River area, to engage in logging and balata bleeding.

The main language spoken in all Cottica Ndyuka communities in Ndyuka. Sranantongo, Suriname's national creole language, is also widely understood and spoken. Because of their proximity to Moengo and the main road to Paramaribo, many people also speak some or fluent Dutch, though men more so than women. The head of each village is the *kapitein*, who is supported by administrative assistants called *basja* (also: *basya* or *basia*). The *kapitein*s, *head-kapiteins* and *basjas* together form the traditional village authorities, and as such reside under the Ndyuka *granman* (paramount chief) in Drietabiki, Tapanahoni region.


Ricanaumofo
O.S. Ricanaumofo (school)
Wonoredjo
Moengo
Adjoema Kondre
La Providencia (school)
Benati Mofo
Akale Kondre
Oost-West Verbinding
Julianaweg
Weyneweg
Kraboe Olo
Dantapoe
Pelgrim Kondre (school)
Mora Kondre
Pati Kondre
Koenersi Kampu
Leewani Kampu
Ovia Olo
Kasaba Ondro
Legend
Beneficiary village
Elementary school
Village that will not be connected to grid

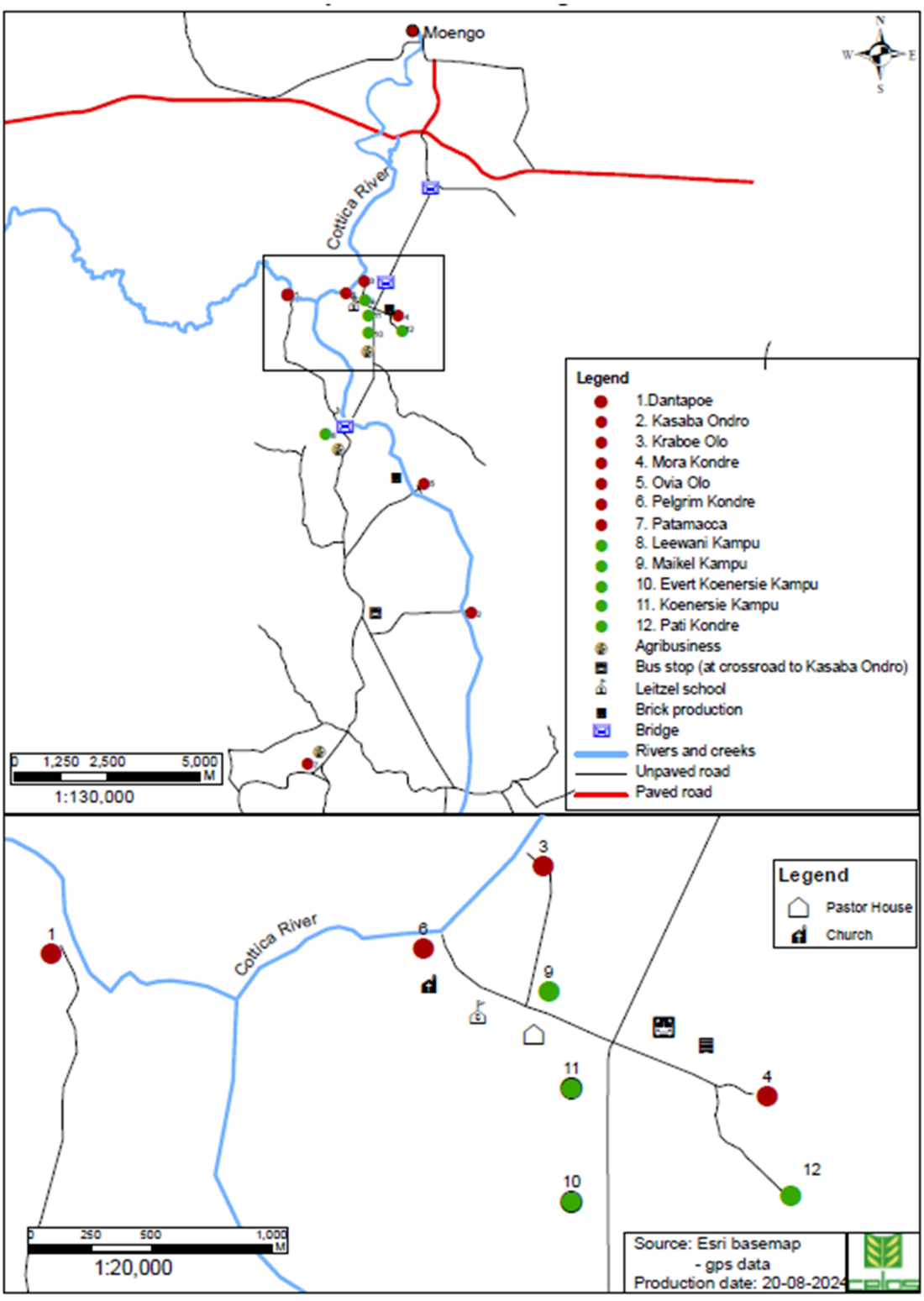


Figure 17. Villages (red) and kampus (green) south of Moengo

4.2.4.2 Selected beneficiary villages

The location of the beneficiary villages is depicted in Figure 4. A more detailed map of the villages (red) and kampus (green; settlements that do not have a village status) south of Moengo is provided in Figure 6. Summary information for the villages is provided in Table 2 at the end of this paragraph.

With regard to the connection of beneficiary villages to the SWM grid, there are three different situations:

I. The villages north and east of Moengo have already been connected to the SWM grid:
   - Ricanaumofo: 148 household connections
   - Abadukondre: 47 household connections
   - Benati Mofo: 35 household connections
   - Akele Kondre: 36 household connections

II. Four villages south of Moengo will be connected to the SWM network: Mora Kondre (incl Pati Kondre), Kraboe Olo, Pelgrim Kondre and Ovia Olo. Nearby kampus such as Leewani Kampu, Koenersie Kampu and Maikel Kampu will also be connected.

III. Three other villages south of Moengo are currently not listed among the beneficiary villages for becoming part of the SWM network, because of their locations and the expenses of becoming connected: Dantapoe, Kasaba Ondro, and Patamacca are. It is planned that these villages will be supplied through water trucks that will be acquired through the project.

SWM customer services data suggest that most complaints from the connected villages (Category I) are related to water leakage, which results in high bills (Figure 18).

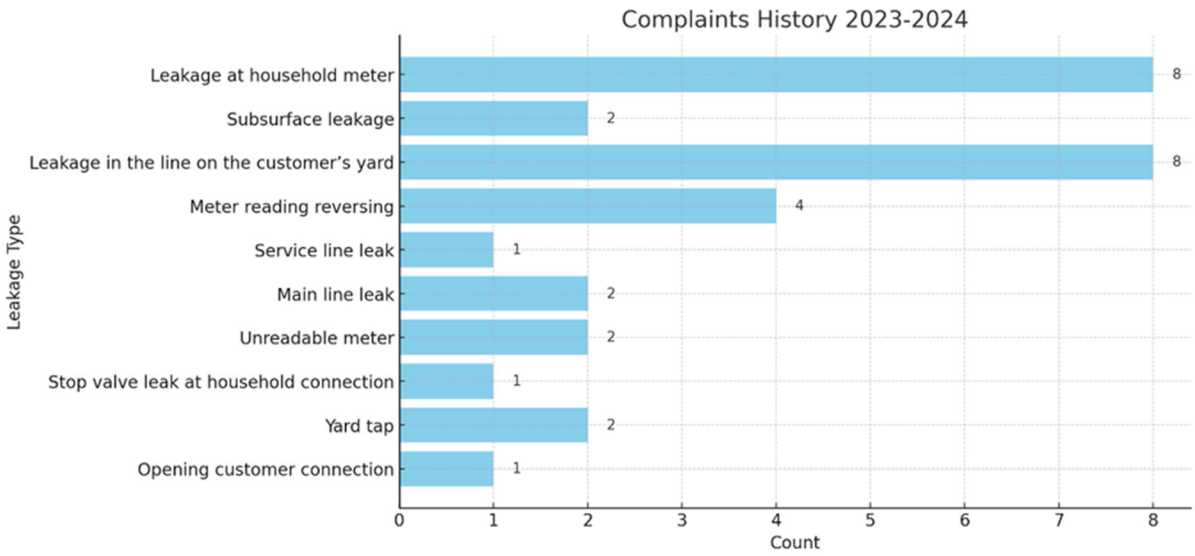


Figure 18. Customer complaints history from connected beneficiary villages, 2023-24

Abadoe kondre

Abadoe Kondre is located approximately 3 km from Moengo (SWM plant), close to the East West connection road (main road). School children walk to the school of the Diocese, just across the main road. For medical care people go to Moengo. Electricity is provided by EBS, but people do not pay for it.

The village counts 45 houses, with 183 inhabitants (Haarlo, 2022). All houses are connected to SWM and have their own meter. Three households have water taps inside, in the kitchen and the bathroom. All other households only have an outside tap.

Sometimes the SWM water is dirty, and then they let the water settle for a while, use rainwater, or buy bottled water. Sometimes there is no SWM water at all for several hours. Generally, when the water does come, water pressure is good. Many people in the village have a durotank to collect rainwater. A few individuals reported that they were afraid that air pollution also pollutes the rainwater, and they do not drink it.

SWM does not come frequently to check the meters, and the monthly fees are high; all above SRD 500 (~EUR 14/month). A consulted woman with an outside tap reported that she uses the water for drinking and bathing in the morning, and to cook. For all other household uses such as washing clothing and dishes, and bathing in the afternoon, she goes to the river. Still, her monthly bills are typically about SRD 1000 (~EUR 28)[3]. She reported that she had consulted with SWM several times about the high bills, but without avail. Also, other people complained about limited customer friendliness at the SWM service desk.

The rainy season (March – July) causes the river to burst its banks. When the water retreats, waste from the shores of this and other villages flows into the river, making the water dirty and unsuitable for most household uses during these months.

[3] In comparison, households in the city with a shower, flush toilet and several inside taps often pay much less than this.

Benati Mofo

Benati Mofo is located just across the road from Abadu Kondre, at about 3 km from Moengo. The villages count about 35 houses. School children walk to the school of the Diocese, about five minutes away. For medical care people go to Moengo. Electricity is provided by EBS, but people do not pay for it.

There are no community taps. All households have been individually connected to the SWM grid and have a meter. When the houses were built, the villages were not yet connected to the grid, and most houses still do not have a tap inside because the piping works are very expensive. They have a garden tap and haul the water inside when needed. Only two houses have a tap inside, with a sink. These households also have a toilet inside, that can be flushed with water. All houses have an outhouse (*kumakoisi*) behind the house.

Most households own a *durotank* (Figure 19) and use this water for drinking alongside the SWM water. Villagers complained that the SWM water is sometimes very dirty: it is either brownish or white like chalk. On those days, they drink rainwater or buy bottled water. Sometimes they let the SWM water sit for a while, so that the particles can settle. They do not boil the water. The water pressure is good.

Figure 19. Durotank with cloth to prevent dirt from falling in, Benati Mofo

For washing clothes and dishes, and for bathing, most adults and elderly, especially women, still prefer to go to the Cottica River. Gathering along the river has an important traditional, social and cultural meaning. It is the place where all people meet, share information and gossip. Young people often bath at home, but they still wash the dishes in the river.

SWM comes to check the meters monthly, and people need to go to Moengo to pay. Various people complained about high water bills, and indeed some of the observed bills were over SRD 1000 (~EUR 28). This seems like a high amount for people who also use durotank and river water for various household uses and may indicate leakage.

Some of the meters have been placed on problematic locations, such as right in people's driveway (Figure 20).

Figure 20.SWM Meters in a driveway, preventing the family's car from entering, Benati Mofo

The Diocese between Abadoe Kondre and Benati Mofo, and the La Providence school

The Roman Catholic Diocese was allocated a piece of land that was part to Abadu kondre, bordering Benati kondre. This land was used to build a church, an elementary school (serving Abadu Kondre, Benati Mofo and Akale Kondre) and a boarding school[4], the Maria Consulatrix internaat. In addition, six households live on the terrain of the Diocese. There also is a large building with rooms for visitors, and the Faith Based Organization Pater Albrinck Stichting (PAS). Electricity is obtained from EBS and paid for.

All teacher's houses do have a tap with a sink inside, as well as an inside flush toilet. Also, the school has toilets and taps at the sink.

Akale Kondre

The village of Akalekondre is located approximately 3 km from Moengo (SWM plant), close to the East West connection road (main road). The village has no school, children walk to the school on the terrain of the Diocese, between Abadoe Kondre and Benati Mofo. For medical care people go to Moengo. Agricultural work and working for the government are the main means of income. Electricity is provided by N.V. Energiebedrijven Suriname (EBS).

The village counts 30-35 houses but many are empty. The village floods (Figure 21) almost annually for some days to several weeks in a row, which has motivated people to move away. Waste from the shores of this and other villages flows into the river when the water retreats, making the water dirty and unsuitable for many household uses during these months.

Figure 21. Flooding Akale Kondre. Source : Suriname Herald, 2018

[4] Boarding school for children between 10-16 years, from the Cottica Area and Patamacca area, who go attend school either at the Diocese (elementary school) or in Moengo (middle school).

Like in Abadoe kondre and Benati Mofo, the SWM water is sometimes dirty, and prices people need to pay for water are (too) high, which may indicate leakage. For example, one consulted lady who only has one tap outside had a most recent water bill of about SRD 1200 (~EUR 32).

The water pressure is generally good.

Few houses have a *durotank*. Elderly people usually go to the river for bathing and washing clothes and dishes, out of tradition.

Ricanaumofo

Ricanaumofo is located approx. 8 km driving North of Moengo, on a paved road. Before entering the village, a couple of houses can be found along the road, as well as a chicken farm. The village has a public primary school with more than 100 pupils, and a Baptist church. There is no clinic. The main income earning activity is commercial agriculture. Harvests are sold in Paramaribo. The village has a foundation named 'the planters' (the farmers).

Ricanaumofo counts an estimated 736 inhabitants (Haarlo, 2022). The households have their own separate connections to the SWM grid but all with an outside tap; None of the 170 households that have been connected to the SWM grid, features in-house tap water or an inside toilet. Each households have its own meter and like in the other villages, community members complained about the high water bills. For example, one elderly woman who lives by herself, has one outside tap, and uses river water for bathing and washing clothes and dishes, pays about SRD 800 (EUR 22)/month for water. This is much more than people pay in comparable situations elsewhere in Suriname. Consulted villagers reported that they were planning to unite to visit the SWM to demand an investigation in the high water bills.

Like in villages west of Moengo, the water pressure is good, but water quality is not consistently suitable for drinking. The water is often dirty, with visible particles, and sometimes white and "foamy".

Some villagers own a durotank and use this water for various household uses such as drinking, cooking and washing clothes. The villagers also rely on the Cottica River, for bathing, and washing clothes and dishes.

Mora Kondre and Pati Kondre

Mora Kondre is located along the Patamacca road, 6.5 km from Moengo. Mora kondre was completely destroyed by the military government during the interior war (1986-1992). In the past decade people have started to return, a trend that has been stimulated by the connection to the electricity grid in 2020. The village now counts 10 permanently inhabited households with 20 permanent inhabitants. In addition, there are 19 houses with more than 110 persons who visit the village regularly but do not live there permanently.

Figure 22. Brick making workshop along the road to Mora Kondre

Just behind Mora Kondre is the settlement Pati-Kondre, named after a friar ("pater" in Dutch) who used to live there. Pati Kondre counts 22 permanent residents in six households. There are no houses of non-permanent residents.

Along the road to Mora Kondre, there is a brick making workshop, which produces bricks for surrounding villages (Figure 22).

The main income sources for both men and women from Mora Kondre and Pati Kondre are the sale of agricultural products, government income or stipends, and social benefits such as General Old-age Stipend - AOV)

Inhabitants of Mora Kondre and Pati Kondre mostly rely on rainwater harvesting for drinking. In the dry season, or for those who do not have a durotank, the Cottica River and the Nairboro Creek are used. Most houses have an outdoor outhouse, but newer houses (also) feature an indoor flush toilet. Garbage is burned, and sometimes a garbage truck is paid to collect the garbage. Phone reception in the village is poor; only at specific locations can one receive a (Telesur) phone signal.

Kraboe Olo, Koenersi Kampu and Maikel Kampu

Leaving Mora Kondre, and crossing the main road, one first passes the small settlement Koenersi Kampu on the left-hand site, a small cluster of houses (Maikel Kampu) on the right hand side, and next on the right hand side a small road leading to Kraboe Olo.

Koenersi Kampu counts 6 permanent households with 35persons; Maikel Kampu counts 2 households with a total of 14 persons, and Kraboe Olo counts 17 permanent households with 106 inhabitants and 2 additional non-permanent households (29 non-permanent inhabitants). Children either visit the school in Pelgrim Kondre, which is a 10-minute walk from the village, or one of the elementary schools or middle schools in Moengo. Main income generating activities are the sale of agricultural produce, social benefits including old age pensions, and government payments to traditional authorities. Along the main road, a little beyond the side road to Koenersi kampu, Pelgrim Kondre and Kraboe Olo, is a large agricultural camp of Evert Koenersie. This person reportedly has formal land lease title to this place (*grondhuur*) and has started to plant vegetables and fruits for sale. In addition, he plans to keep ducks at the place.

For Medical care people go to Moengo. The village and settlements were connected to the electricity grid in the year 2020. People use water from durotanks and the Cottica river.

Pelgrimkondre

The village of Pelgrimkondre differs from the other villages because it only houses a church, a school and a few, mostly uninhabited houses. There are 2 inhabited houses with a total of 11 permanent residents: the household of the pastor along the road to Pelgrim Kondre, and a household of a schoolteacher. In four houses, non-permanent residents come for weekends and holidays (8 persons).

The school and the church are part of the Wesleyan Church society (formerly known as the Pilgrim Holiness Church). The Leitzel school is the only school along the Patamacca road. Every school day, the school bus takes children from nearby villages to Pelgrim kondre, unless there is a strike or the bus is broken. The Leitzel school counts 44 pupils (Table 1) served by 8 teachers, including the principal. The classes are small. Years 1 and 2 sit together, and all other years have their own teacher. The principal does not have her own class, but she takes over in case of an absent teacher. These small classes allow for a lot of personal attention and may in part explain why there are no drop-outs. According to the principal, it is common for children from the Leitzel school to continue to secondary education (MULO or LBO) after completion of 6th grade (year 8).

Table 1. Number of children attending the Leitzel School

Year	# Boys	# Girls	Total
1 (Pre-school 1)	4	3	7
2 (Pre-school-2)	3	0	3
3 (Grade 1)	4	0	4
4 (Grade 2)	2	4	6
5 (Grade 3)	1	2	3
6 (Grade 4)	5	4	9
7 (Grade 5)	5	2	7
8 (Grade 6)	4	1	5
Total	28	16	**44**

The Leitzel school is reasonably maintained and was recently painted (Figure 23). Nevertheless, the building suffers from pests such as bats, mice, moths and wood lice.

The school has several durotanks, received from Newmont and a Dutch development organisation. In the dry season, when there is no water left in the durotanks, the principal buys water from SWM Moengo. This water which is paid for by the Ministry of Education or in other cases by the school board. One durotank is put on an elevated platform and provides water to flush the toilets. The principal explained that when the water stays in the tanks too long, larvae grow in the water.

Figure 23. Rev. Leonard Leitzel elementary school

The school has electricity provided by a solar system donated by Newmont Suriname in 2016. Garbage is being burned. There is good telephone reach for both Telesur and Digicel customers.

Ovia Olo

Ovia Olo is located on 15.7 km driving distance from Moengo (or 12.2 km in a straight line). The village counts 56 permanently inhabited households and about 267 permanent inhabitants. In addition, there are two houses for 10 non-permanent residents who come in weekends and holidays. Main income generation activities for men are logging, agriculture, government jobs, and two persons work for mining multinational Newmont. In addition, Ovia Olo features a brick making workshop, which was developed by the village organization Exploitatie Maatschappij Ovia

Olo (ExMO NV) (Figure 24). Three of the young men working in this brick making workplace completed the Newmont brick making and masonry training in 2023.

Ovia Olo has Catholic Church. Children mostly attend school in Moengo, where they travel by school bus. For medical assistance the inhabitants also go to Moengo. Since 2020, Ovia Olo is connected to the EBS grid.

For drinking water, people rely on rainwater harvesting with durotanks. For other household uses and in the dry season, people also use water from the Patamacca Creek.

Sanitary systems in the village include indoor flush toilets, outhouses, and one hole with a small hut over it. Garage is being burned, and the garbage truck reportedly comes bi-weekly. There is good phone reach through Telesur.

Figure 24. Brick making workshop in Ovia Olo

Leewani Kampu

Leewani kampu is a small agricultural settlement along the Patamacca road, just beyond the roads to Kraboe Olo and Mora Kondre. The place counts three houses, inhabited by four persons from one family. The women from Leewani Kampu perform commercial agriculture (Figure 25). The households in Leewani Kampu use rainwater and bottled water. Occasionally, the SWM truck supplies the kampu. The houses either have an indoor flush toilet or an outdoor outhouse.

Figure 25. Tayerblad and Celery production, Leewani Kampu, February 2024 (Social Solutions)

4.2.4.3 Vulnerable Groups

Suriname is the only country in the Americas that has not legally recognized the collective rights of Indigenous and tribal peoples to the lands and resources they have occupied and used for centuries. This places these peoples, including the Cottica Ndyuka Maroons, in a particularly vulnerable position, as their lands can be, and have been, granted in gold, agricultural, and logging concessions to third parties. There is no legal requirement to compensate these people for lost lands, as the lands that they live on and use for their livelihoods are not legally theirs.
International Human Rights dictate that in order to work on Indigenous and Tribal lands, Free Prior and Informed Consent (FPIC) must be obtained. The NMA also demands that the Project must ensure that the FPIC principle is applied in decision-making processes related to communities of the indigenous and tribal peoples. In the present context, this means that the prior to building project infrastructure in and around the communities, such as the water towers, the Project manager and contractor must engage with the relevant Maroon communities and properly inform them about potential impacts, positive and negative.

Like many other families from the interior, the inhabitants of the Cottica Ndyuka villages are predominantly low-income families. Furthermore, in all traditional villages there is a disproportionate share of elderly (60+). The government old-age benefits (AOV) are insufficient to live off and as long as people are still physically capable, they plant their crops. People in the villages take care of the elderly. For example, people help each other when they need to get medication in Paramaribo. In addition, children living in Paramaribo and French Guiana help out, both financially and in person when they visit.

Table 2 provides a summary information of project villages in the Moengo area , i.e. only those that are or will be connected to the grid

Table 2. Summary information of project villages in the Moengo area (only those that are or will be connected to the grid)

Village	# Permanent households	Est. # inhabi-tants	Water provision*	Water quality	Payment and price	Distance from SWM Moengo[5]
Ricanaumofo	170[6]	736[7]	Connected to SWM. People also use rainwater and bottled water	Complaints that SWM water is regularly either brownish or chalk-white and has particles.	People pay based on SWM meters. Bills are very high, mostly surpassing SRD 500 or 1000	6.5 km
Abadu kondre	45	183 [14]	Connected to SWM. People also use rainwater and bottled water	Complaints that SWM water is regularly either brownish or chalk-white and has particles.	People pay based on SWM meters. Bills are very high, mostly surpassing SRD 500 or 1000	2.7 km
Akale kondre	30-35	413 [15]	Connected to SWM. People also use rainwater and the Cottica River	Complaints that SWM water is regularly either brownish or chalk-white and has particles.	People pay based on SWM meters. Bills are very high, mostly surpassing SRD 500 or 1000	3.3 km
Benati mofo	30	142 [14]	Connected to SWM. People also use rainwater and the Cottica River	Complaints that SWM water is regularly either brownish or chalk-white and has particles.	People pay based on SWM meters. Bills are very high, mostly surpassing SRD 500 or 1000	3.2 km
Kraboe Olo, Koenersi Kampu & Maikel Kampu	25	155	Rainwater harvesting and use of the Cottica River	Most houses do not use a filter for rainwater harvesting systems so dirt from roof tops (leafs, sand, dust, bird poop) runs into the collection bins. River water is polluted, One needs to let it settle.	N/A	6.8 km

[5] As the crow flies

[6] 170 households are SWM clients. Some studies name 200 households, but they may include houses that are no longer (permanently) inhabited.

[7] Haarlo, 2022

Mora kondre & Pati Kondre	16	42	Rainwater harvesting and use creek water (Njun Buru creek, Naiboro creek) and Cottica River.	Most houses do not use a filter for rainwater harvesting systems so dirt from roof tops (leafs, sand, dust, bird poop) runs into the collection bins. River water is polluted, one needs to let it settle.	N/A	7.6 km
Ovia olo	56	267	Creek water (Patamaca creek) and rainwater harvesting. Occasionally water truck	Most houses do not use a filter for rainwater harvesting systems so dirt from roof tops (leafs, sand, dust, bird poop) runs into the collection bins.	N/A	12.2 km
Pelgrim kondre	2	11	Rainwater harvesting and use of Cottica River	When the water stands too long in the bins it may get larvae. It needs to be controlled well.	N/A	7.3 km

* Since SWM lacks adequate trucking facilities, there is currently no water truck that supplies the Southern villages. Customers that purchase water to be supplied by the truck do get it delivered. These are villagers of Ovia Olo & Patamacca

4.2.5 Social Impacts of the Proposed Project (WTP Moengo)

Land use and resettlement

No resettlement is required for the Moengo project. Ongoing land acquisition by SWM is for the water intake near market, the strip of land between the Cottica River and inlet road to Moengo port. If the SWM does not manage to purchase the identified piece of land, the WTP can still be built.

The Moengo Port, officially named the Traymore Moengo Port (Figure 26) is privately owned. The total acreage of the port approximately 2000m² and includes 14 bollards for mooring and unmooring. If SWM wishes to use land that is part of the port, or the access roads to the port, it will need to discuss the conditions of use and access with N.V. Traymore.

Figure 26. Traymore Moengo Port. Source: https://www.traymorenv.com/en/gallery

With regard to the 4 water towers at the outskirts of the villages, SWM must communicate with the traditional village authorities. There are currently no people living at the selected locations, and the land is not used for livelihood activities.

Employment

The Moengo project will provide short-term job opportunities during construction; particularly manual labour. It is advised that local people will be hired as much as possible for project activities. This must be made explicit in the tender document for the contractor. No long-term job opportunities are foreseen, possibly some maintenance activities.

Archaeological, historic and cultural sites

The national registry for archaeology lists several known pre-Columbian archaeological sites along the Wanekreek and Cottica River, and their tributaries. These recorded sites are most likely only a small selection of actual sites[8]. The lack of national register status does not mean that additional cultural heritage (Indigenous or Maroon) sites do not exist in or near proposed project sites around Moengo, incl. the location of the new SWM plant and projected locations of new piping.

In the case that such sites are encountered during construction activities, the work must stop, and the adequate authorities must be notified, as described in the section about Van Hattemweg.

Noise, vibration, dust, traffic, and exhaust gas emission

Construction activities are primarily related to the construction of the new water plant in Moengo, and construction of the water towers at Ovia Olo, Mason Town (Koenersi Kampu), Ricanaumofo, and Abadoe Kondre. These activities will cause regular construction noise, vibration and dust, as well as occasional obstruction of traffic and exhaust gas emissions from the vehicles and heavy equipment. No piling is foreseen.

Conflict and social discontent

The fact that some villages will be connected to the SWM network and others in the same area will not, may generate tension and discontent. The differences in water supply create differences in water pricing:

- Beneficiary villages south of Moengo will receive free water from community taps.
- Beneficiary villages north and east of Moengo pay for water, based on their meters.
- The villages of Dantapoe, Kasaba Ondro and Patamacca will not become part of the SWM grid but instead be supplied with water trucks. Water from water trucks is much more expensive than regular tap water.

Given these differences, it is possible that the not-connected villages will feel disadvantaged and express discontent towards the project team and SWM.

[8] For example, Suriname's archaeological record is biased toward pre-Columbian sites, with Maroon archaeological sites reported, identified and excavated, but not placed on the national register of heritage sites.

Social benefits

The Moengo project will improve water quality for clients in the Moengo area. In addition, the project will connect about 100 households (~500 persons) in low income rural Maroon communities to the national drinking water grid.

Affordability

The total water bill that people in the connected villages (house-connections) pay is the sum of

- Amount of water used multiplied by tariff,
- BTW
- Meter rental
- And eventually penalty cost and repair cost

SWM reports that sometimes the expenses seem high, when the meter reading is corrected, and the bill displays the accumulated expenses for consumption. According to the SWM, average water usage of household of 4 persons is 18 m^3. This would cost SRD 558, for a total bill of SRD 627.90 (Meter Rental is SRD 40., BTW is 5% = SRD 29.90 with)

Several villagers reported that they were paying more than SRD 1000/month, and could show the water bills. It is unclear why these bills are this high, especially considering that people continue to use rain, river and creek water for many household uses.

Like elsewhere, households in the Project area are disconnected from the grid when there are more than 2 outstanding payments. This occurs about once a month in the connected Project villages.

Buying from the water trucks is more expensive than being connected to the SWM net: SRD 913.50 for 6m3 water, incl. transport; about 4.4 times the price paid by metered clients. This disadvantages the villages that will receive truck water.

4.2.6 Recommendations

Environmental

Make sure the water intake facility at Moengo New WTP is well between surface and bottom of the river to prevent as much as possible the intake of possible pollutants (oily components from surface or heavy metals from the bottom sediments). The intake facility must be provided with a screen to prevent fish and other organisms to be affected by the pumping system.

Another option is to use an intake at the riverbank, using the sand layers next to the river as a first filtering step. However, the suspected uneven permeability of the riverbank (mostly fill material) might not be suitable for this option.

Improve the monitoring protocol for the water intake and up-stream, to make sure that in case of pollution intake can be stopped in time. Especially oily components, pesticides and heavy metals (such as Pb, and possible Hg from mining activities in the inlands) are of importance).

NOTE:
Accidental spills from shipping, loading, offloading, port handling and storage at the Traymore facilities next to the WTP could possibly contaminate the Cottica River and have a negative influence on the quality of the water SWM uses at the intake point. For this reason SWM has taken the following precautions:
- the reallocation of the intake point about 250 meters up streams;
- the installation of continuous water quality monitoring and alarm system;
- extra storage of intake water;
With those precautions extra reaction time is gained to prevent chemicals to reach the SWM WTP processes.
However, the responsibility to prevent any spill of chemicals due to accidents, handling, storage, shipping or fire extinguishing at Traymore are beyond our control and should be managed by Traymore following prescription and conditions of NMA. NMA should inspect and control this.
Extra secondary containment or a containerized system could be prescribed along with continuous monitoring and alarm systems. Also, fire protection systems should be installed. In case of fire, contaminated extinguishing water should never reach the surface water.
For the new situation it is proposed to apply proper sludge deposit protocols as described for the Van Hattemweg new WTP.

Health

The cause(s) for occasional poor water quality in the connected SWM villages must be investigated and preferably resolved by either SWM or the Project.

For the extension of the distribution lines, it is important to continuously maintain adequate pressure in the pipelines in order to prevent the intrusion of contaminants in the drinking water.

Because many people continue to use their rainwater harvesting systems, also once connected to the SWM grid, it will be useful to hold information sessions in the villages about safe rainwater harvesting. Such sessions could present information on tank cleaning (frequency and method), filtering systems, and the possible use of chlorine tablets.

Operational

The condition of the existing pipelines which might be used for provision of drinking water to the mentioned villages needs to be assessed. The water balance calculations (production volumes minus billing volumes) as present nowadays seem to indicate that Moengo Town leakage values are low (less than 20%). SWM operators also report low leakage values on the Moengo Network. These figures were however not backed by flow measurements as model calibration (including a flow and pressure measurement campaign) was not part of the contractual requirement.

The quantification of leakage on the Moengo network requires setting up a hydraulically self-contained & representative District Metering Area (DMA) and carrying out night flow measurements at WTP outlet after at least 48h of continuous water supply to the town of Moengo. This exercise (which could be part of a future NRW reduction project in Moengo) would provide Net Night Flow values (NNF - indicative of leakage) which could then be extrapolated to the entire town of Moengo to obtain global Leakage values.

Social

In order to minimize nuisance to inhabitants and prevent social unrest, at the new WTP at Moengo, the project should:

-Be transparent about the project and its implications in the different villages, during communication with the villages in the area. Communication must prevent creating false expectations.

-Discuss the construction activities (duration, working hours, activities) with traditional leaders and area inhabitants, through a joint meeting, community meetings, or house to house visits. Respect local input into the schedule and works as much as practically possible.
-If the nearby bridge is used for the transportation of heavy material, take quiet hours into account (e.g. evening/night).
-Limit noise from transportation and construction activities during school hours.
-Monitor impact of dust production on school and offer solutions. For example, if the schools need to keep their windows closed to prevent project-related dust from entering the classrooms, ventilators may be installed to provide air.
-If taking transportation route through Moengo village, preferably no transportation between 7:00h-8:00h and between 12:00h-14:00h, when school children most likely use the same roads.

- Transportation contractors must adhere to strict safety regulations, especially where residential areas are used for transportation.
- If the river is used for transportation, other water users must be informed in time through media and personal communication. There are villages on the other side of the Cottica River and area inhabitants use the river for transportation and fishing. This must be researched prior to river usage.
- In the case of transportation of heavy materials on the river, the Maritime Authorities Suriname (MAS) must be notified.
- Limit noisy construction activities during church hours (Sunday morning).
- Discuss with Traditional Authorities if there are areas in the village with special cultural/ spiritual significance that may not be disturbed. Also discuss the desire/need for specific rituals at the start of project activities. In some villages people adhere to specific taboos (e.g. a certain day during the week, during which labour may not be performed); discuss these issues as well as ways in which the contractors can perform the work efficiently while respecting local culture.
- No construction activities near/in the church terrain during church hours.
- As much as possible, hire local community members for construction activities.
- Ensure that contractors performing the work have followed a briefing/training on safety and ethics.

5. Overall Conclusions and Recommendations

The overall project and all its components will have a very positive impact on the supply of save drinking water for the population of Paramaribo, the city of Moengo and the remote villages in the region of Moengo and in a later stage possibly also to Commewijne.

Drinking water production and distribution in general do not present high risks from an environmental, health or social point of view and this is also the case for these SWM activities.

No major environmental impacts have been detected, nor in the existing situation neither after proposed project implementation. The environmental issues are limited to minor aspects of construction and operation and can all be well controlled and improved without mayor changes in the original project design. Groundwater and surface water intake does not take place in specific ecological sensitive areas.

The responsibility to prevent potential pollution spills in the Cottica River as a result of accidents, handling, storage, shipping or fire extinguishing at the Moengo port are beyond the control of SWM and should be implemented by the Moengo port authorities following prescriptions and conditions from the NMA, who should monitor implementation.

For the project components of WaSIIP it can be concluded that none of the components has significant negative impacts on the environment, which would impede its further implementation. Some extra measures are necessary to reduce the minor impacts that were detected, especially the better treatment of sludge and the gaseous emissions.

Also, from a social point of view, the project is positive, contributing to a better standard of life. Willingness to pay seems not to be a bottleneck in the project areas.

The original selection of villages to be included in the project might be reviewed, based on the recommendations in this report.

Table 3 : Summary of potential impacts

Human beings	
Disruption of traditional and Current Land uses	There are no inhabitants on the SWM premises in Moengo anymore, Van Hattemweg all works on own SWM premises.
Labour Force (short and long term)	Short term positive during construction of pipelines and new plants. Long term slightly positive for operation of new and extended WTP plants and maintenance, truck drivers.
Archaeological and Cultural resources	No impact foreseen as long as described practices will be applied.
Flora and fauna	
Clearing of Vegetation	Van Hattemweg be constructed on existing cleared SWM premises. At Moengo new area no vegetation available. Pipeline extensions are along existing roads. Pipeline from intake point Moengo to filter house is constructed under existing road.
Soil erosion	Pipeline extensions might cause minimum erosion along the existing roads. Given the rainy climate this will be overgrown soon.
Storm water and effluent Discharges	At the WTP's the process water will be discharged after sedimentation. At Moengo at present all process water is discharged in the future this will sedimented first and sludge will be removed and brought to the landfill.
Noise and Vibration	Some noise will be generated during construction works of the plants and pipelines, but this is temporary only. The operation of the WTP plants will cause only very low noise levels. Described practices for minimization should be applied.
Physical environment	
Flooding in low-lying areas	n.a.
Erosion Sedimentation	Sediments from the WTP will be deposited at the dumpsites of Moengo and Ornamibo. The material is non-toxic and can be used as covering layer at the dumps. No sanitary landfills are existing in the country.
Aesthetics	The plants will all be construction in areas already in use for the same purpose. No big changes are foreseen in the visual aspects and aesthetics of the locations.
Receiving water quality	
Construction phase impacts	Construction and demolition should be carried out following standard protocols where the waste is collected, recycled and sent to a dumpsite in an organized manner. No waste should be left on the premises after construction or dumped uncontrolled on land or in waterways.
Operation Phase impacts	The overflows of the sedimentation ditches will bring suspended solids to the river, along with some polymers and flocculation chemicals in the case of Moengo.
Air Quality	
Vehicle and Equipment emissions	Minor emissions due to construction trucks and possibly trucks bringing water to the remote villages around Moengo.

	Air emissions of Methane and H_2S will occur at the groundwater treatment plants in non-significant amounts. Some smell might be generated but this will not be noticeable in the vicinity.
Services and Utilities	
Demand for electricity, Water Supply, Telecommunications and Waste disposal	The extension of extraction of groundwater, the extension of pumping for water transport over longer distances through pipelines and the processes at the WTP itself will raise electricity consumption.
Traffic	
Increased traffic during all phases of the project	Truck movements for construction materials and possibly for water transport to the villages.
Obstruction of roads	Some short time traffic hindrance might occur during pipeline construction.