1. General

The Weija water supply system is divided in three sub-systems: Weija-Adam Clark (Canadian-New Works), Weija- Candy and Weija-Bamag.

The common raw water source of the three sub-systems is the impoundment created by Weija Dam, with a storage volume of 115 Mcm.

The reservoir supplies 2 No. raw water pumping stations, the Canadian Pump House and the Old Pump House.

The three treatment plants are all of conventional type, including aerator (not all), clarifiers, filters, chemical plants, storage. The treated water is supplied by gravity to the service area.

2. Population and Water Demand

Weija supplies Accra Rurals D and E and with New Kpong the Accra metropolitan area as shown in the table below.

The population served by Weija is not known when preparing this system profile, however this proposal considers only the rehabilitation of the system to restore its design capacity.

SYSTEM NAME	No.	LOCALITY NAME	ESTIMATED POPULATION					PROJECTED WATER DEMAND (M3/DAY)			
			2005	2007	2011	2015	2025	2005	2,007	2011	2015
Old Kpong	1	Accra Rurals A	232,891	249,830	287,597	331,228	472,424	10,647	11,716	15,099	18,289
Old Kpong	1	Accra Rurals B	80,971	85,458	95,209	106,099	139,245	4,056	4,359	5,746	6,774
Old Kpong	1	Accra Rurals C	70,158	73,723	81,406	89,891	115,184	4,606	4,913	5,852	7,218
Weija	2	Accra Rurals D	32,842	35,522	41,556	48,615	71,962	2,080	2,628	3,410	4,135
Weija	2	Accra Rurals E	28,126	30,224	34,914	40,353	58,077	1,673	1,826	2,203	2,654
		Total Accra Rurals	444,989	474,757	540,682	616,185	856,891	23,063	25,442	32,310	39,070
New Kpong	1	Accra Met	649,340	695,589	798,205	915,958	1,292,050	58,645	64,095	78,064	93,039
Weja	2	Accra Met	1,106,016	1,184,792	1,359,576	1,560,145	2,200,739	95,312	104,141	125,850	155,418
New Kpong & Weija	1&2	Accra Met	215,000	230,313	264,290	303,278	427,804	19,512	21,275	26,013	30,930
		Total Accra Met	1,970,356	2,110,695	2,422,071	2,779,382	3,920,593	173,468	189,511	229,927	279,387

3. Existing Surface Water Supply System

3.1 Dam and Intake

Coordinates: N 05° 34.319', W 0° 20.597', altitude: 22 masl.
An earth-filled dual-purpose dam (water supply and irrigation) was constructed in 1978 to replace an older one washed away during the rainy season of July 1968. Part of the impounded water is used for irrigation in the dry season.

The River is the Densu which has its source in the Akwapim Hills in the Eastern Region. Poor environmental practices along the river adversely affect the raw water quality. The result is the need to dose huge quantities of Alum for treatment. Use of poly-electrolytes is actively being pursued. A trial treatment with activated carbon has

also proved extremely successful, removing most of the odor imparted to the water mainly by algae.

Raw water supplied to the treatment plants is 30 mgd (136,000m3/day).
The potential yield of Weija reservoir is reported by Royal Haskoning to be 260,000 m3/day.

The dam is provided with 5 No. openings; each opening is provided with sector type gate, hydraulically actuated and with a stoplogs groove upstream the gate. The stoplogs are to be maneuvered by means of an electric lifting/ manual displacement type gantry crane.

During Consultant's site visit, the water level was below the top level of the gates and only one gate was open, to allow the water over-topping the stoplogs, installed in the same opening, to flow downstream. This was done to allow some of the algae to be removed downstream.

This practice of overflowing the stoplogs is not safe and not recommended; however, there is no other way to remove the algae.

The intake is provided with three sluice gates, enabling the abstraction of raw water from the most appropriate level. The raw water channel, supplying both RWPSs is provided with 2 trash racks; the cleaning is by means of a mechanical basket able to lift the debris.

Presently the automation of the system is faulty and there are difficulties in operation.
The basic electric supply of the intake is ensured by a substation including 2 No. transformers rated 5 MVA each, operated in parallel. Presently, their automatic voltage adjustment is faulty.
A stand by power plant including 4 No. diesel generating sets rated 750 kVA each and an additional service one rated 60 kVA, could not be visited.

The power supply to the 3 No. treatment plants located at the headwork is transmitted from this substation through two buried 3.3 kV cables. One of the cables is faulty and has to be urgently replaced.

3.2 Canadian RWPS

This plant supplies the Adam Clark treatment plant.
It includes 4 No. deep well turbine pumps with asynchronous electric motors of slipping ring type, all supplied on 3.3 kV. During the visit, 3 No. pumps were operated, but the operation regime may change to only 2 No. pumps in operation. The characteristics of the equipment are the following:

-1 No. Byron Jackson/Canada pump, Q=2,016 m3/h, H=113m, n=975 rpm, powered by a Westinghouse motor, P=1,200 HP. This is to be decommissioned, (and replaced by a Nijhuis pump(?)).
-3 No Nijhuis/Holland pumps, Q=2,250 m3/h, H=115m, n=992 rpm, powered by Alstom motors, P=1MW.

All the pumps are operative.

The auxiliary equipment of the pumping station includes:

-electric overhead crane;
-2 No. two stages electric compressors for the completion of the air cushion of the two surge vessels;
-2 No. surge vessels installed outdoors; their volumes are 25 m3 respectively 15 m3 and are directly connected to the rising main of the new RWPS, without isolation valve.
-the electromagnetic flowmeter installed on the discharge pipe is not operative.

Raw water is supplied to the Adam Clark water treatment plant through a 42 in diameter raw water pipeline.

3.3 Adam Clark Water Treatment Plant

This plant was built in the early 1980s and extended and re-commissioned in 2002; presently its capacity is rated at 29.5 mgd = 134,000 m3/day.

The water treatment process first step consists of cascade aeration. Alum is applied here, after which the water is passed through a distribution chamber with baffles to ensure proper mixing. This is followed by clarification through 4 No. clarifiers, followed by filtration through 8 rapid gravity filters and disinfection by means of chlorine gas or calcium hypochlorite. After pH correction with lime, the treated water is stored in 2 No. clear water tanks, each of 4,500 m3 capacity.

An on-going expansion construction contract is presently carried out; it consists of the following construction works:

-2 No. additional clarifiers are under construction, to bring the total to 6No.
-4 No. additional gravity filters is also in progress, to bring the total to 12 No.

Construction and Operational Details:

-The raw water reaches the cascade aerator, where a dry alum feeding installation is installed, to make use of the post aeration turbulence for mixing. An old sprinkler type aerator has been abandoned.
-The flocculator is a concrete serpentine baffled channel. It is followed by a dividing chamber, which divides/adjusts the flow to each clarifier;
-The clarifiers are of circular type, provided with a scraper bridge, central flocculator and automatic electric desludging valves; one of the valves has been seen in operation, during discharging;
-The sludge from the clarifiers, as well as the waste backwash water from the filters is not recycled; however, a circular thickener is present; it is provided with a scraper bridge; the system is not presently in use;
-The filters are of rapid gravity type, with one lateral distribution channel, of "false floor" and nozzles type. The flow regulating system is out of order. All valves are electrical with manual override. Some of the filters are loosing sand through the slabs of the false floor. The backwash system is by means of scour air and backwash water. The following equipment is installed in the filters bottom gallery:

-3 No. scour air blowers Ementhaler, Q=2,720 m3/h, powered by a BBC motor P=45 kW.

-3 No. pumps which are filling an EWT with the capacity 1,400 m3;

-3 No. motive water pumps Ouijvelaar/Holland, P=9.2 kW.

All the equipment is in good order.
-Chemical preparation/ dosing plant:

-2 No. alum preparation tanks, each with an electric stirrer, operational (now not used- dry alum dosing used);

-3 No. lime preparation tanks, each with an electric stirrer and dust exhaust installation, operational (now only two are used);

-2 No. HTH preparation tanks, each with an electric stirrer, operational (now not used- chlor gas installation used);

-The existing dosing pumps (of screw type) are not satisfactory (as a matter of fact, almost scrap); with extreme efforts, one of them is managed for the lime dosing.

-Chlor gas installation: it includes a chlorine drums room and chlorinators room; in the chlorine drums room, a scale, a change over device, a manual 2 t overhead crane and all the other necessary equipment are installed; in the chlorinators room, beside the chlorinators, the motive water piping and valves are installed; 2 No. residual chlor analyzers are also present. All the equipment is operable.
-Active Carbon Plant: presently not in use; it could not be visited.
-Clear Water Tank: it consists of underground reinforced concrete structure, with a capacity of 2 x 4,500 m3.

3.4 Transmission, Storage and Distribution

The supply from Weija-Adam Clark water treatment plant is carried out by gravity, through 2 No. 36" and 1 No. 21" transmission pipelines to Accra distribution network.
There are a lot of problems related to the insufficient supply, low pressure, impossibility to clean the reservoirs, insufficient storage capacity.

These problems are not presented here.

3.5 Rehabilitation / Expansion Works Carried out/on going/Planned

Presently there is an on-going rehabilitation/ expansion contract; the main works to be carried out in the system have been briefly presented at para.3.3.

4. Proposed Rehabilitation (2008) and Expansion (2011)

4.1 General

The system will continue to be based on surface water abstraction, pumping, conventional treatment, storage and distribution.

The capacity of the system will be increased from the present one of 134,000 m3/day to 159,000 m3/day, by means of an on-going construction contract. The works pertaining to the expansion are not considered in the present assessment.

The system will continue to serve the same service area.

During the rehabilitation/ expansion proposed works, remedial works will be carried out in the RWPS and treatment plant. The transmission mains, storage and distribution system are being developed under the said on-going construction contract; since details of this contract are not available, no recommendations are given here for this part of the system.

4.2 Supply Vs Demand

Year	2008	2011	2015	2025
Water demand (m3/day)				
Present design capacity (m3/day/ mgd)	134,000/29.5			
Present water production (m3/day/ mgd)	128,000/28.2			
Expected water capacity after rehabilitation/ expansion (m3/day/ mgd)		159,000/35		

4.3 Dam, Intake and RWPS

Rehabilitation 2008:

-General measures to be gradually undertaken throughout the Densu River catchment to reduce the pollution (organic and anorganic); this will ultimately reduce the algae growing and nitrification conditions and improve the raw water quality.
-Implement a motorized system of the dam gantry crane “along” displacement.

-Repair the trashrack cleaning system of the intake.
-Repair the 2 No. transformers voltage regulator (tap automatic changer).
-Laying a stand by electric underground 3.3 kV supply cable between intake and headwork, to replace the faulty one.

Expansion 2011:

-Supply and install a new deep well turbine type raw water pump, Q=2,250 m3/h, H=115m, P=1MW.
-Supply mechanical and electrical spare parts including electrical panels components and power factor compensating installation.
-Supply and install a DN1000 electromagnetic type raw water flowmeter.

4.4 Adam Clark Water Treatment Plant

Rehabilitation 2008:
-Supply spares such as clarifiers desludging valves, tyres for scraper bridges, etc.
-Supply and install filters flow control system.
-Supply and install complete system of dosing pumps and appurtenances for alum, lime and HTH preparation/ dosing plants.
-Supply and install complete system of sampling pumps and appurtenances.

Expansion 2011: no works are recommended.

5. Scheme Components and Estimated Costs

The basic data and cost estimates of rehabilitation and expansion of Weija Adam Clark treatment plant are shown in Tables 2A.0, 2A.1 and 2A.2.

6. Proposed Scheme for 2015 and 2025