Sierra Leone Waterpoint Report

Review Version – 26th June 2012

Ministry of Energy and Water Resources

with support from

This review report was compiled by Maximilian Hirn. Please send comments to: mhirn@worldbank.org

Executive Summary

The Sierra Leone Waterpoint Report is the result of a comprehensive mapping exercise carried out in 2012. Led by the Ministry of Energy and Water Resources, all public improved waterpoints in Sierra Leone were surveyed – over 28,000 in total. The full dataset has been published at www.SL-wash.org.

This report gives an overview of the collected data and highlights key lessons that can be drawn from it. The in-depth information contained in the new dataset provides an empirical basis for investment planning and can help strengthen sector policies. Among the many aspects of Sierra Leone's waterpoint infrastructure described in this report, five critical insights and recommendations stand out:

Five Key Insights & Recommendations

A clear case for increased investment: The data provides a clear empirical case for further investments, and a basis for prioritizing these. Thousands of points require repairs and many new points need to be built in areas that are lacking adequate safe water supply. Detailed, systematic investment planning is required to identify areas of particular need within districts, and to mobilize funding to meet these.

Seasonality a major problem – Guidelines required: Seasonality is a major problem in Sierra Leone, with up to 40% of protected in-use points providing insufficient water during the dry season. This is generally due to insufficiently deep wells or an inappropriate choice of waterpoint location. Clear policies and standards should be formulated to improve the quality of point construction and reduce seasonality.

Breakdown rates are high – Strengthen ownership and management: The rate of damage of public waterpoints is high and rises rapidly with point age. Among points built in 2007, almost a third (31%) are impaired, and 17% broken down. Evidence from the survey suggests that points that are actively managed, have local ownership or nearby access to a mechanic and spareparts perform significantly better. To strengthen sustainability, management and ownership of waterpoints needs to be improved.

Improve Coordination among external agencies and government: In the last three years alone, over 25 major implementers have been actively building and funding waterpoints in Sierra Leone, in addition to smaller NGOs, government agencies, utilities, local communities, religious groups and private persons. In some chiefdoms, up to seven different external agencies were active. This is clearly suboptimal as better coordination could reduce overhead costs and improve planning.

Standardize pump models: Unless there are specific local or technical reasons, future construction should give preference to India Mark II type handpumps. These are already the most popular model, constituting 64% of all handpumps, and further standardization of models will allow the sector to economize on sparepart supplies and training of mechanics.

I. Introduction

The Sierra Leone Waterpoint Atlas is the product of a comprehensive mapping exercise carried out by the Ministry of Energy and Water Resources (MoEWR) and its partners in the first half of 2012. Over 28,000 public improved waterpoints across all of Sierra Leone's districts and chiefdoms have been mapped during this period. The exercise constitutes a comprehensive update of the earlier Statwash initiative. This document presents and analyses this data in detail and proposes a set of distinct policy recommendations.

The waterpoint mapping exercise has been led by the Water Supply Division (WSD) of the Sierra Leonean Ministry of Energy and Water Resources, with support from the World Bank's Water and Sanitation Program (WSP), UNICEF, the Adam Smith International and other national and international partners.

This Atlas is structured in four broad sections: The next section will outline the scope and methodology of the mapping project, including all relevant definitions such as what is meant by an "improved" waterpoint. This is followed by a chapter giving an overview of the key statistics, insights and maps at the national level. Subsequently, the current Strategic Sector Plan is considered, and total investment requirements and prioritization are discussed and key insights are summarized. Finally, county-level maps are provided.

All waterpoint data that was used for the statistical analysis and maps in this Atlas is available online in great detail and different formats (Excel, ESRI Shapefiles, KMZ) at: http://www.SL-wash.org

II. Scope and Methodology of the Mapping Exercise

This project mapped and surveyed all public improved waterpoints in both urban and rural Sierra Leone, covering the entire national territory. The mapping exercise was thus comprehensive and not on a sample basis. The data in this Atlas is up-to-date as of April 2012.

Definition of a "public improved waterpoint"

The definition of an "improved" waterpoint follows international standards. According to the international definition provided by the World Health Organization and UNICEF, an improved waterpoint is "one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with fecal matter."[i]

It is important to note that this definition is essentially a technical one – if a water source is constructed in a way that one can assume it is protected, then the point is counted as improved. The water itself is not tested under this definition. Thus, for instance, a public standpipe that is technically fully functional is assumed to be an improved source of water– the water itself is not being tested. This is a necessary

simplification, because it is generally not possible and cost efficient to test the water quality in a laboratory for each and every waterpoint in large or remote areas.

Table 1: List of improved versus unimproved/unimproved water-sources

Improved Water Sources	Unimproved Water Sources
Piped water into house or yard	Unprotected spring/creek
Public tap or standpipe	Unprotected dug-well
Pump on hand-dug well or borehole	Water sold from handcart
Protected Spring / creek	Tanker-truck
Rainwater collection	Surface water (e.g. lake, river)
Protected dug well	Bottled water (case-by-case)

In practice, waterpoints that were constructed with at least a raised concrete apron and a permanent lid were generally counted as improved points. Unimproved sources have not been mapped, because it would have multiplied the workload without adding to the primary purpose of this Atlas, which is to show where the population has access to improved waterpoints, and where it does not, and how access to improved points could best be expanded.

Pictures 1 and 2: Examples of an improved (=mapped) and unimproved (=unmapped) waterpoint

Protected Well

Unprotected Well

This exercise mapped only *public* waterpoints and by "public" is meant publicly accessible. In other words, a waterpoint may be built by a private person (who may even charge money for it), or owned by a private organization, but as long as it was improved and accessible to the public in a non-discriminatory manner, it was surveyed.

III. National Results

Total Number and Functionality

The total number of surveyed improved public waterpoints in Sierra Leone is 28,845. Of these 18,080 (62.7%) are technically functional, a further 4,148 (14.4%) were functional but partly damaged[ii], while 5,137 (17.8%) were recorded as broken down. Another 1,480 points that were still under construction at the time of the survey were also mapped. A key figure is the combined number of points that are either fully functional or at least without major damage.[iii] There are 20,284 of these in Sierra Leone, of which **18,908 (65.5% of the total)** are actually used. These are referred to as "protected in-use points" below. The main reason that some protected points are not used is pollution i.e. users reporting that the water is unclean (e.g. cloudy, salty, rotten taste etc.).

Table 2: Number and functionality of Sierra Leone's public, improved waterpoints

Waterpoints by functionality	Number	% of total
All public, improved waterpoints	28,845	100%
Under Construction	1,480	5.1%
Broken Down	5,137	17.8%
Partly Functional	4,148	14.4%
Fully functional	18,080	62.7%
Protected, in-use points	**18,908**	**65.5%**
….of which are seasonal	7,696	-

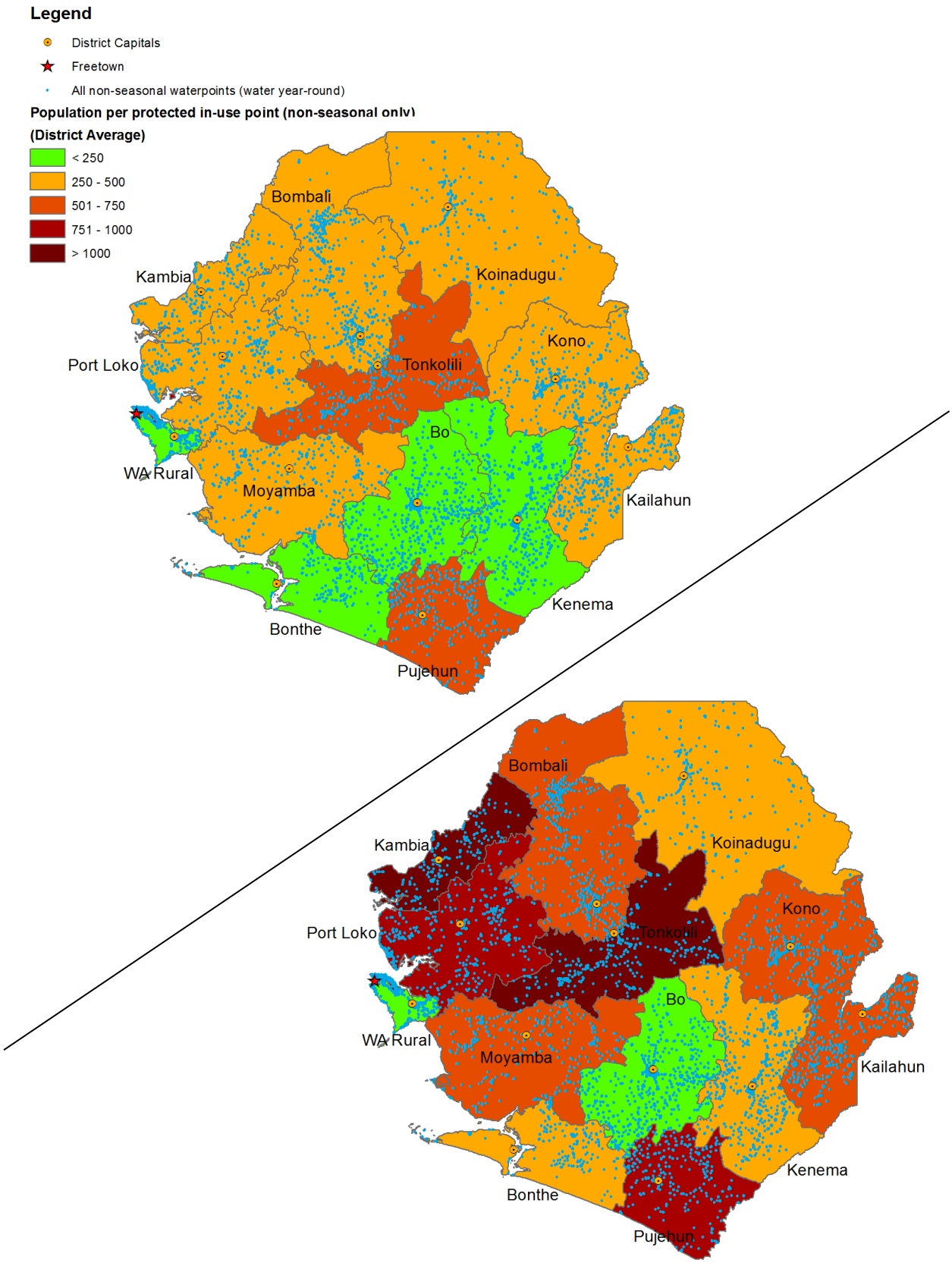
Even among these 18,908 protected, in-use points, up to 7,696 (over 40%), are seasonal, giving enough water only during the rainy season. Thus, the number of points that are protected, technically working and in-use throughout the year is only 11,212 (39% of the total). The large number of damaged points indicates serious shortfalls in ensuring the sustainability of constructed waterpoints, and the high rate of seasonality points to a systematic problem in selecting well-locations properly and drilling deep enough.

Map 1 below shows the location of all surveyed waterpoints as blue dots, and indicates the district average population per protected in-use point. Greenly shaded districts achieve an average service level of more than one point per 250 persons, whereas the orange and red shaded districts (the latter including Freetown) miss this basic target. The exact population per point statistic is provided by district in Table 3. The population per waterpoint should be 250 or lower, because, technically, a typical waterpoint's capacity is limited to servicing at most 250 to 300 persons safely and sustainably.[iv]

Seasonal points are included on this first map, and as can be seen on Map 2, dry-season performance is considerably worse. This is clearly a major problem throughout the country and better standards and guidelines for well construction (for instance on how to select the correct location and well-depth) could save funds lost on points that do not perform as intended.

Though difficult to see on national overview maps, Table 3 shows that Western Area Urban i.e. the Freetown capital district has the lowest overall and second lowest dry-season coverage in the country.

Map 1 & 2: Location of surveyed waterpoints and district average service levels [non-seasonal for Map 2]



There are a number of possible explanations for the apparent underperformance of the Freetown capital area: Firstly, Freetown experienced extraordinarily fast population growth during and after the war, with the population spiraling from around 500,000 to approximately one million today. Public infrastructure has simply struggled to keep up with this growth. Secondly, the Freetown urban area has more than 10,000 private connections provided Guma Valley Water Company, and private water-tanks also supply a considerable number of residents. In other words, some areas that appear particularly underserved by public points (e.g. the wealthier Western neighbourhoods), may simply be supplied by private sources instead, which were not mapped. Finally, some areas of Freetown border Western Area Rural, which is comparatively well supplied by public points. Thus considerable number of Freetown residents living in these district-border areas may draw water from nearby W.A. Rural points.

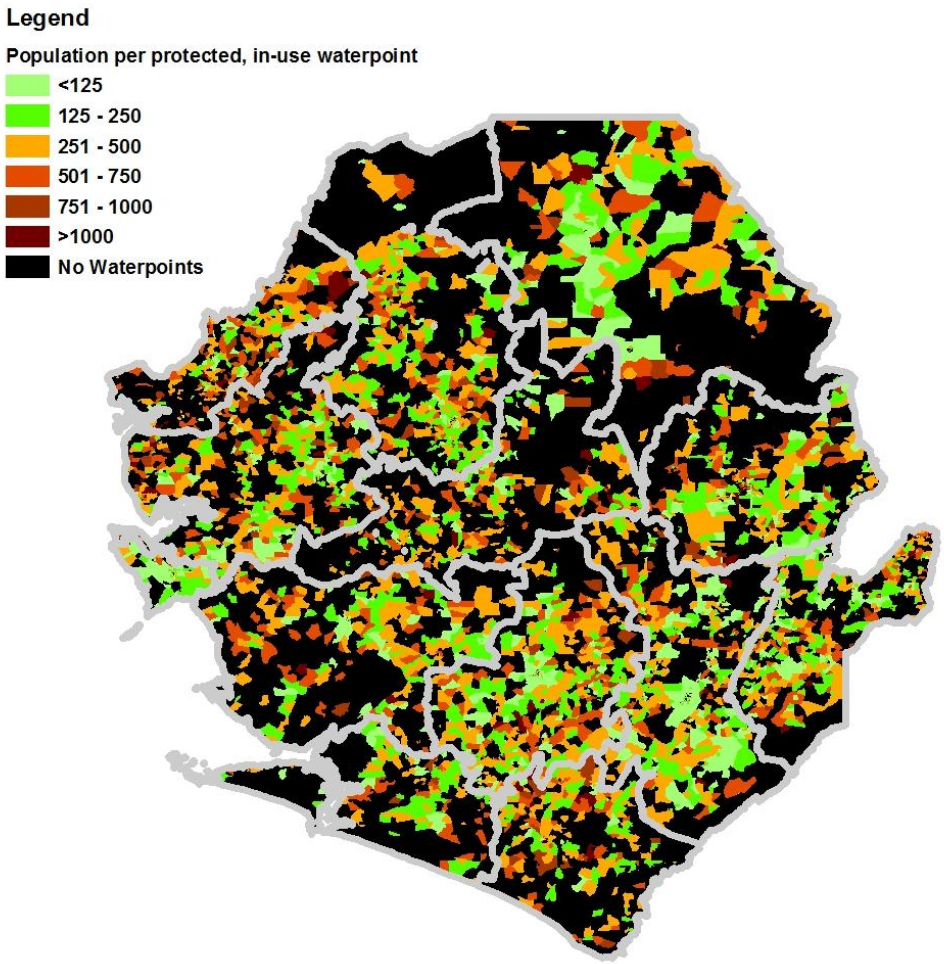
Table 3: Number of all public improved points and protected, in-use points by district

District	**Population**[v]	**All public points** (incl. broken & under construction)	**Protected, in-use points**	**% of all**	**Population per protected in-use point**[vi] (non-seasonal in brackets)
Bo	544,745	4,902	3,437	70%	157 (235)
Bombali	485,888	2,429	1,584	65%	302 (617)
Bonthe	165,604	1,022	693	68%	239 (440)
Kailahun	422,781	2,299	1,546	67%	261 (527)
Kambia	320,842	992	596	60%	480 (1426)
Kenema	592,903	3,659	2,754	75%	203 (289)
Koinadugu	312,682	1,782	1,141	64%	251 (496)
Kono	399,113	1,994	1,269	64%	311 (549)
Moyamba	304,262	1,685	990	59%	291 (583)
Port Loko	536,862	2,013	1,340	67%	363 (935)
Pujehun	265,608	767	491	64%	530 (755)
Tonkolili	410,869	1,742	745	43%	535 (1012)
W.A. Rural	209,275	1,865	1,338	72%	147 (187)
W.A. Urban (Freetown)	976,984	1,694	984	58%	866 (1237)
Total	**5,948,418**	**28,845**	**18,908**	**66%**	**300**

District averages of waterpoints, as outlined in Maps 1 & 2 and Table 3, must be interpreted with care as they do not account for local pockets of underperformance. Communities in one part of a district may be severely lacking in waterpoints even as other communities in the district are well supplied. Map 3 below highlights just how fragmented performance really is once the analysis is taken to a more local level.

Coverage rates can be calculated by comparing the actual population to the number of persons the existing waterpoint infrastructure within an administrative area can safely supply. Excluding Freetown and Bo (where unmapped safe water sources play a bigger role), initial estimates based on this method yielded an access rate of between 50-80% depending on whether seasonal points were counted. As with the population per point statistic, however, the local variations are immense, with sections with access rates below 25% being no rarity.

Map 3: Population per protected, in use-waterpoint (incl. seasonal points) by Enumeration Area



Analyzing the improved public waterpoints by construction date reveals a high rate of breakdown over time. As Diagram 1 highlights, even among those points constructed just one year ago, 22% were impaired (partly or fully broken), and 9% broken down. The breakdown rate rises rapidly with point age, among those built in 2007, almost a third (31%) are impaired, and 17% broken down. Almost half (44%) of those built before 2003 are impaired, and almost a quarter (24%) broken.

Diagram 1: Waterpoint Damage by Construction Date

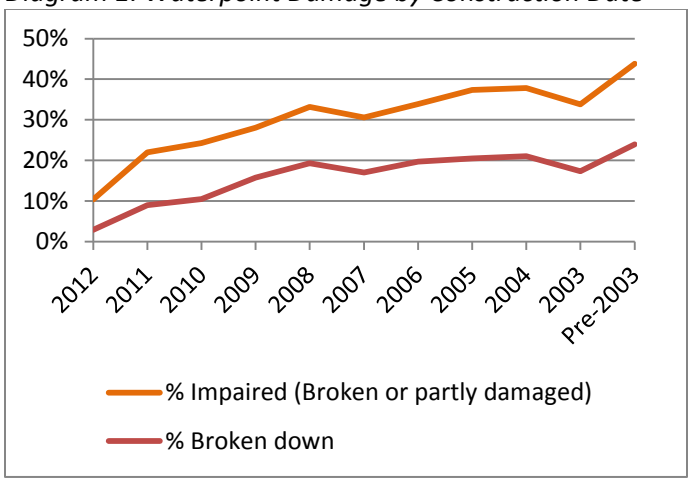


Table 4: Impact of Management on Damage Rates

Percentage of Impaired Waterpoints (partly damaged or broken down)	%
All Waterpoints	32.2%
… in community with sparepart supplier	22.1%
… in community with trained mechanic	24.6%
… regularly chlorinated	22.9%

Interestingly, waterpoints that are situated in communities with a sparepart supplier, a trained mechanic, or points that are regularly chlorinated have impairment rates of up to 10% less. Indeed, impairment was lower for such points for each age-group analyzed. This suggests that points that are under active management (of which chlorination is a proxy indicator) and/or within easy reach of a mechanic and sparepart suppliers, are in better repair than points that are not. It highlights the importance of these factors in improving point-sustainability, which constructing agencies should not neglect.

Waterpoint functionality also differs by implementing agency as shown by Table 5, which highlights impairment rates by major implementers. What immediately stands out is that the best performers with the least percentage of impaired pumps are those who tend to be local and to have close ownership of the waterpoints – private persons, local communities and religious groups. Major NGOs and federal government institutions tend to do less well. While the importance of local ownership of waterpoints is a pertinent observation, for a correct assessment one has to factor in the average construction date. For instance, while it is true that public improved waterpoints installed by Salwaco and GVWC tend to have high breakdown rates, the infrastructure managed by these entities is also considerably older on average. Moreover, GVWC and Salwaco waterpoints are disproportionately tapstands which can be more susceptible to minor damage than standalone waterpumps.

Table 5: Damage rates by major implementers

Implementing Agency	% Impaired (partly or fully broken)	Difference to Average	Average Construction Date[vii]
Major NGOs[viii]	42%	+ 8%	~ Oct' 2001
… w/o WaterAid[ix]	39%	+ 5%	~ Apr' 2004
UN Agencies	39%	+5%	~Aug' 2002
Community	31%	- 3%	~Aug' 2004
Government	42%	+ 8%	~May 2001
Salwaco	48%	+14%	~ June 2001
GVWC	54%	+20%	~Nov' 2001
Religious Groups	33%	- 1%	~Nov' 2005
Private	16%	- 18%	~Nov' 2004
Total[x]	**34%[xi]**		**~Jan' 2003**

Table 6: Damages by category

Damage Type	Number
All Impaired Points (broken down)	9,285 (5,137)
… with major damage[xii]	7,081
… with multiple damage	2,876
… pump related damage	3,291
… apron/concrete related	1,937
… pipe related damage[xiii]	1,929
… well related damage	1,688
… tank/network related	1,176
… reservoir related	267
… other types of damage	1,148

The total number of impaired points is 9,285, of which 5,137 were judged to be broken down by survey staff i.e. unsafe and in a state in which the original delivery mechanism (e.g. the handpump) was not providing water anymore. The remainder of the 7,081 points with major damage are comprised of 1,944 of points *partially* damaged, but judged to have serious damage even while retaining some basic functionality. The most common type of damage is pump-related, ranging from issues like stolen handles, pump-heads to damage to u-seals and valves.

The high demand for easily accessible waterpoints is illustrated by the fact that more than 50% of broken down points, and more than 85% of partially damaged points continued to be used for drinking despite the damage. In the case of broken down points, users would, for instance, bypass broken hand-pumps or ignore missing protective lid and simply use points as unsafe waterholes. Overall, 23,407 of the surveyed waterpoints (85% of the total) continue to be used.

Picture 3: Continued unsafe use of a broken down handpump with an improvised bucket

In identifying waterpoints suitable for cost-effective rehabilitation, stakeholders should concentrate not only on areas of need, but on the sub-set of impaired systems that are still in-use (indicating availability of potable water), and that have no major, expensive damage. The waterpoint database can provide stakeholders with this information.

Waterpoint Types

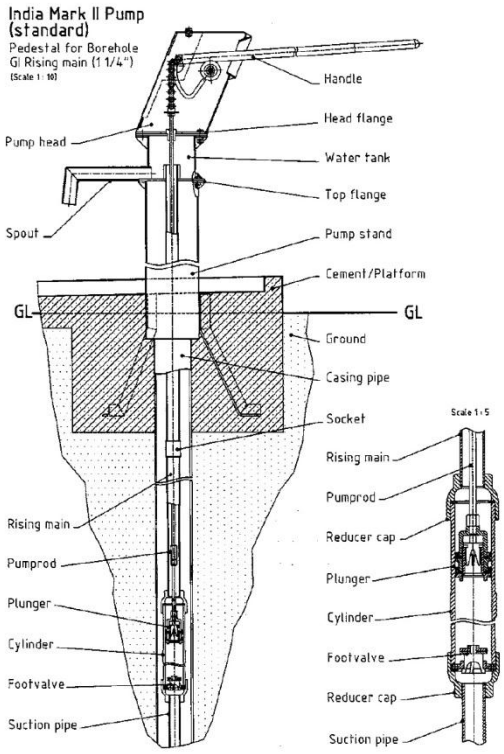
The most common type of public, improved waterpoint in Sierra Leone is the handpump. Among handpumps, the most popular model is the India Mark (II) pump, constituting 64% of all manual pumps and 27% of all waterpoints. Pictures 4 and 5 below illustrate the India Mark (II) pump model. The second most common handpump model is the Kardia pump. By contrast, the Afridev model, which dominates in neighbouring Liberia, is relatively rare in Sierra Leone.

Pump-model distribution has profound implications for future construction and the associated issues of sparepart supplies and training of mechanics. To economize on procurement, mechanics training and to simplify sparepart supply chains, future construction programs should focus on the dominant models –

India Mark (II) and Kardia. The use of other handpump models should be discouraged if possible, unless there are compelling local reasons (e.g. a local concentration of a particular type).

Picture 4: Villagers with India Mark II Pump

Picture 5: India Mark II Outline[xiv]



The second most popular type of improved public waterpoint is the simple protected well without fixed pump or lifting device, but covered with a lid to prevent animal droppings, carcasses or other pollutants from contaminating the water. Sierra Leone has over 8,000 such wells across. While these basic protected wells constitute a significant improvement over uncovered, unprotected water holes, they are generally less safe than handpumps due to possible contamination while the lid is opened, or the use of improvised buckets and ropes to lift up the water. Indeed, when comparing the prevalence of reported "unclean" water across waterpoint types, simple protected wells performed significantly worse than wells with pumps or tapstands (see Table 7). They are less convenient to operate than pumps. The protected wells without pumps may be suitable targets for upgrading.

Picture 6: Protected Well with raised lining and lid

The third major category of improved waterpoints are standpipes or tapstands. There are over 7,000 of these, often with multiple taps at one point. These taps are fed with water from extensive piped networks in Freetown and some other cities, and local reservoirs elsewhere. While

the reported quality of the water at standpipes and tapstands seems to be relatively good compared to other points (see Table 7), this subjective, user-provided information should be ascertained through a sample of chemical and bacteriological tests. In Monrovia (Liberia) such an exercise showed significant contamination with E.Coli and other pollutants across point-types.

Table 7: Reported quality by point type

Waterpoint type	Water reported "not clean"
Standpipe	3.6%
Water Kiosk with Tank	11.8%
Manual pump	11.8%
Protected well (no pump)	16.3%

Table 8: Waterpoints by Type (and manual pumps by model)

Type of Point	Total Number by type	Type %	Protected & in-use by type	Type %	% protected & in-use
Manual Pumps					
India Mark (II)	7,315	27%	5,039	27%	69%
Kardia	2,373	9%	1,838	10%	77%
Afridev	477	2%	345	2%	72%
Inkar	374	1%	273	1%	73%
PB Mark II	241	1%	153	1%	63%
Consallen	82	0.3%	37	0.2%	45%
Vergnet Footpump	23	0.1%	13	0.1%	57%
Unidentified pump type	436	2%	249	1%	57%
Points without manual pump					
Protected Well (no pump)	8135	30%	6155	33%	76%
Standpipe or Tapstand	7037	26%	4270	23%	61%
Water Kiosk with Tank	525	2%	295	2%	56%
Protected Spring	243	1%	183	1%	75%
Submersible Pump	29	0.1%	17	0.1%	59%
Rain Harvesting	15	0.1%	9	0.05%	60%
Other	60	0.2%	32	0.2%	53%
(Under Construction)	(1,480)	(-)	(-)	(-)	(-)
Total (excl. under construction)	**27,365**		**18,908**		**69%**

An analysis of the construction dates (Table 9) shows a significant uptick in construction activity immediately after the war 2003, with 2,145 new points built compared to only 281 in 2001 and 508 points in 2002. As emergency activity tapered off in 2004-6, so did point construction, before rising again reaching record levels in 2011. In total, 1,480 points were recorded as being "under construction", though around 169 have been so since before 2011 i.e. for these it must be assumed that construction has permanently halted. Table 10 details the current construction activity by district

A wide variety of agencies has been actively funding and constructing waterpoints in Sierra Leone. Just in the period 2009-12, over 25 major external agencies were recorded, in addition to smaller NGOs, government agencies, utilities, local communities, religious groups and private persons.

Table 9: Construction Dates

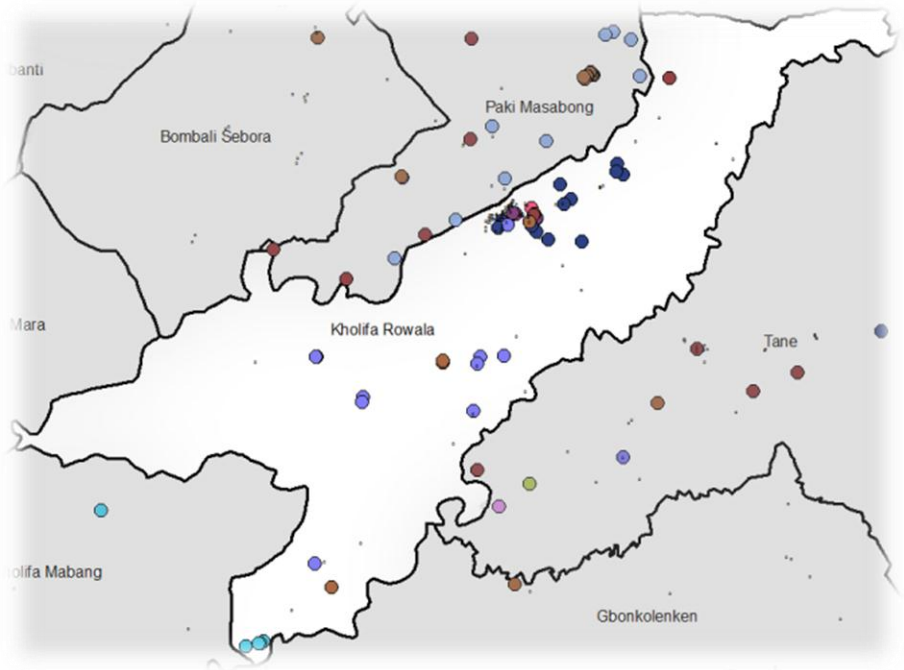
Year completed	All Points	Cum. %
2012 (first quarter)	346	100%
2011	2,850	99%
2010	2,792	86%
2009	1,979	74%
2008	1,744	66%
2007	1,494	58%
2006	1,371	52%
2005	1,233	46%
2004	1,314	41%
2003	2,145	35%
Pre-2003	5.961	26%
Total	**23,229**	
Currently under con.	*1,480*	-
Unknown Age	*4,136*	-

Table 10: Current Construction Activity

District	Points under construction	%
Bo	143	10%
Bombali	113	8%
Bonthe	59	4%
Kailahun	97	7%
Kambia	58	4%
Kenema	146	10%
Koinadugu	53	4%
Kono	67	5%
Moyamba	128	9%
Port Loko	69	5%
Pujehun	46	3%
Tonkolili	123	8%
Western Area Rural	66	4%
W.A. Urban (Freetown)	143	10%
Construction halted (U/C since before 2011)	*169*	*11%*
Total	**1,480**	**100%**

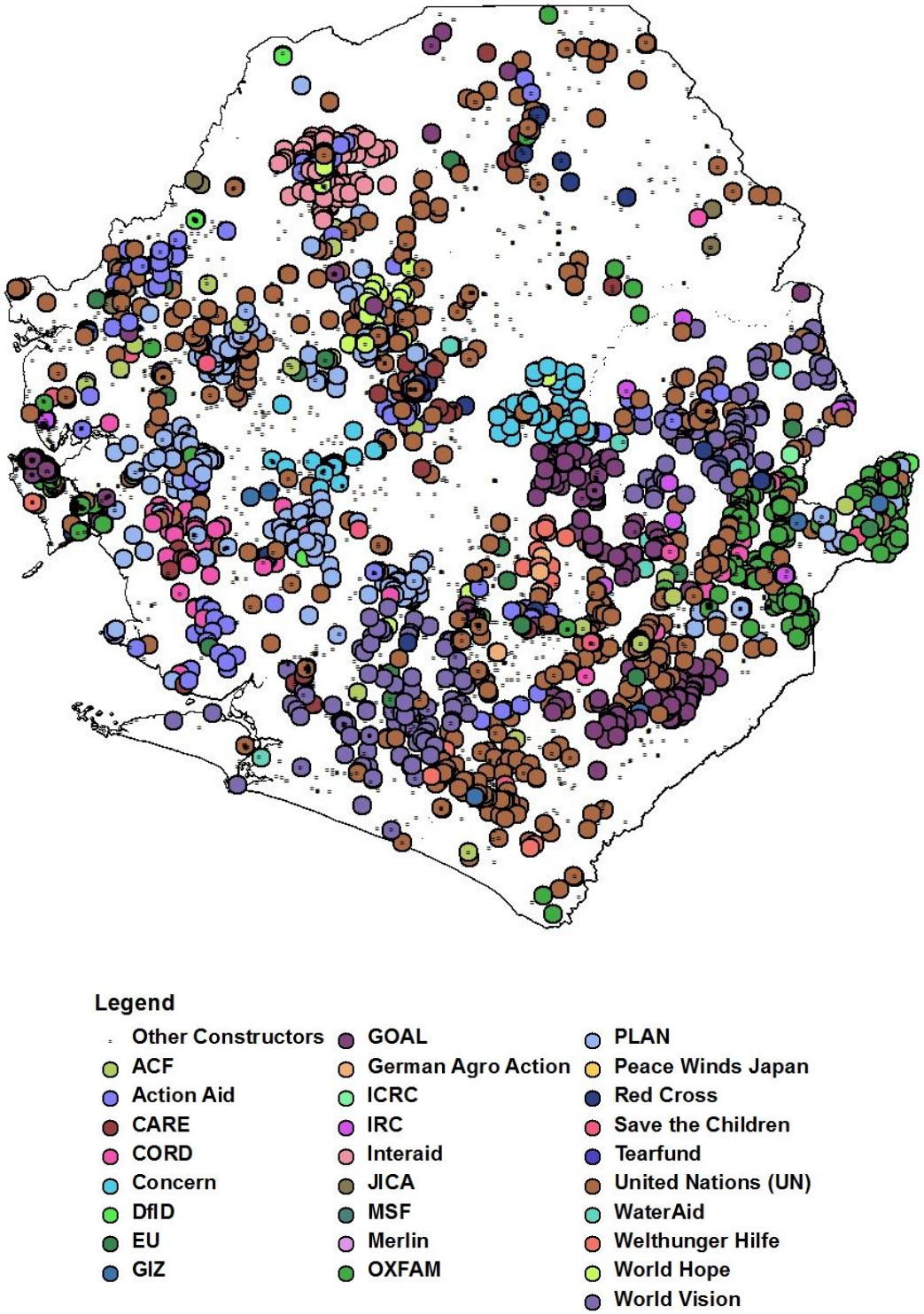
As Map 5 illustrates, there is a lack of overall coordination as many agencies are active in the same region, unnecessarily increasing overhead costs. For instance, in 2009-12, seven different major funders and implementers were active just in Kholifa Rowala Chiefdom (Action Aid, CARE, Concern, GOAL, Red Cross, Save the Children, United Nations) – in addition to government agencies and communities. Going forward, better coordination between agencies will be critical to improve planning and reduce costs.

Map 4: Major external implementers in Kholifa Rowala Chiefdom



Refer to Legend of Map 4 for color coding of implementers

Map 5: Major external implementers in 2009-12 (excludes government, utilities, private, small NGOs)



Note that due to the zoom level, points overlap and not all are visible on this map

As this overview report has attempted to highlight, the Sierra Leone Waterpoint database offers a rich new source of information for the sector.

The great advantage of the data is that it can both give an overall view of the waterpoint infrastructure in the country, and thus lead to insights pertinent for the whole sector, as well as provide very local information for detailed planning. The full data is available at www.SL-wash.org and stakeholders are encouraged to view and work with it, and to be inspired to use this opportunity to improve coordination, planning and investment in the sector going forward.

-

This is a draft report – please send suggestions and comments to: mhirn@worldbank.org

[i] This definition is provided on the official website of the WHO / UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation: http://www.wssinfo.org/

[ii] This partial damage my be major or minor, but unlike a "broken down" point, a partly damaged one will still deliver water through the original infrastructure.

[iii] Major damage here refers to partially damaged points that have damage or pollution of the well itself, or damage to the apron or reservoir, or multiple types of damages. All "broken down" points are also excluded i.e. automatically counted as having major damage that renders the points unsafe.

[iv] UNICEF, WASH Technology Information Packages – for UNICEF WASH Programme and Supply Personel; 2010. See entries for Afridev, India Mark and Vergnet pumps.

[v] Population in 2012 (extrapolated from 2004 census with population growth rates from World Bank database)

[vi] Note that for this calculation waterpoints with multiple taps were counted multiple times to accurately reflect their potential to serve more people. This adjustment affects approximately 417 points across the country.

[vii] Estimated on basis of all points for which construction date is known (thus only approximation)

[viii] The "Major NGOs" category comprises ACF, Action Aid, CARE, Concern, CORD, DfID,EU, German Agro, GIZ,GOAL,ICRC,Interaid, IRC, JICA, Merlin,MSF, OXFAM, Peace Winds Japan, PLAN, Red Cross, Save the Children, Tearfund, Water Aid, Welthunger Hilfe, World Hope, World Vision

[ix] WaterAid has only recently returned to Sierra Leone, but had constructed a large number of waterpoints prior to the war. The average age of WaterAid pumps (1989!) is thus much older than for other NGOs, which impacts the functionality rates. For this reason, NGO functionality rates have also been given excluding the generally much older WaterAid pumps.

[x] Includes Other (esp. minor NGOs) and Unknown Implementers.

[xi] Note that the figure is 34% rather than 32.2% as in Table 1 and 4 because under-construction points are not counted in the denominator here.

[xii] See Endnote (iii) for definition of "major damage"

[xiii] By "Pipe" is mean primarily pipes at or in the vicinity of tapstands

[xiv] Sourced from: UNICEF, *WASH Technology Information Packages – for UNICEF WASH Programme and Supply Personel*; 2010. P.48.