SUPPORTING REPORT I

INSTITUTIONAL ORGANIZATION

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SUPPORTING REPORT I INSTITUTIONAL ORGANIZATION

The previous Master plan reviewed in detail the existing institutional arrangements concerning the management of the Maritza River Basin, and went on to propose measures for the institutional development necessary to promote its integrated environmental management. The review and subsequent recommendations covered the institutional and organizational aspects related to this project from Ministerial level to the Regional Environmental Inspection Offices and other bodies dealing with day to day issues involving environmental issues. The Operation and Maintenance Organization aspect of this Feasibility Study is strictly limited towards recommending measures for the sustainable operation of the proposed wastewater treatment plants *within* the three priority towns of Pazardjik, Dimitrovgrad and Stara Zagora. A review of the organizational arrangements of the entire Regional Water and Wastewater Companies (ViK) of the priority towns, or ViKs in Bulgaria in general, and any proposals for their re-structuring as a whole is excluded.

The JICA Study Team wish to emphasize that the information presented here relating to the institutional and organizational aspects of the ViKs and the individual wastewater treatment plants is based on the results of the interviews conducted with and the information provided by the representatives of those entities. Where possible, this information has been independently verified, as appropriate, by experienced Bulgarian and international experts.

1 General Overview of the Organizational Approach to WWTP Operation in Bulgaria

Officially, wastewater treatment plants (WWTP) in Bulgaria mainly fall into two types, municipal and industrial. There are very few examples of WWTPs designed to treat the combination of loadings from municipal flows and untreated industrial flows. In general, the Regional Water and Wastewater Companies (ViK's) are responsible for operating the municipal plants, whereas it is the individual industries who are, in theory at least, responsible for operating their own industrial pre-treatment plants.

Within the entire Maritza River Basin, there are only five Municipal WWTPs. However, none of these five are to be found in the Maritza River Basin of the Municipalities/ViK's to

which the priority towns belong. In order to gain an appreciation and understanding of the present organizational approach to WWTP operation in Bulgaria, it was necessary to look further afield and at a range of plants of different sizes. In the course of this review, the team visited and interviewed staff at the WWTPs at Sofia, Plovdiv, Ihtiman and Pavel Bania, while visits without interview included Radnevo and Haskovo. Extensive interviews were also conducted with the senior management at the ViKs of the priority towns of Pazardjik, Dimitrovgrad and Stara Zagora to establish their concept of the operation of the new plants and other topics related to the operational organizational aspects of the supply of technical services within the ViK's.

WWTPs are normally included as separate entities under each so-called Technical Region within the ViK; i.e. there is no degree of centralization, regionalization or area/divisional structuring. Of the three priority towns, only Stara Zagora ViK has operating municipal WWTPs within its organization, one at Radnevo and one at Pavel Bania, although neither of these are within the Maritza River Basin. A third WWTP at Kazanlak is due for completion and commissioning early in 1999.

In terms of both organizational structure and practice the three plants at Stara Zagora are/will be isolated from each other. This is not to single out Stara Zagora as a case for bad management (on the contrary, it is the most progressive and forward-thinking of the ViKs interviewed), but it typifies the ongoing organizational approach of the ViKs in Bulgaria. Given the geographical locations of these three WWTPs and clear opportunities for combining services, this is a financially uneconomic structure and one which, in addition, does not promote or allow the staff at the different WWTPs to meet in any official capacity and interact. In common with all WWTPs in Bulgaria, these plants (including the proposal for the unfinished Kazanlak) are grossly overstaffed with each one being a self-sufficient entity. This is not purely the fault of the ViKs', but is a reflection on the old designs developed by Vodokanal Engineering and Vodokanal's estimates for the levels of staffing. However, the ViKs must take some of the blame for this inefficiency as they implemented the Vodokanal proposals, although recently there has been a drive to reduce overstaffing but this has fallen some way short of what is really required.

It is clear that within the current organizational approach to WWTP operation in Bulgaria, there is plenty of scope for rationalization. Although such rationalization would be on a small scale now because there are only a small number of plants, there would be genuine benefits. The scale of these benefits will increase as more WWTPs come on line and there are greater opportunities for efficiency gains. Although we are limiting our comments here to the context of WWTP operation, there are clearly huge improvements to be gained through a thorough review of the structures of all the ViKs as a whole.

The general organizational approach does not appear to vary from one ViK to another, either in terms of overall structure or, more specifically, in terms of the operation of WWTPs, regardless of their size. This is, perhaps, a reflection on the previous centralized system of governmental control where standardization was practiced. As will be demonstrated in the following sub-sections, minor modifications individually tailored to the organizational structures of the three ViKs' to which the priority towns belong will yield positive benefits without the need for the introduction of any radical measures.

2 Review of the Capacity and Capability of the ViKs' to Operate and Maintain the Intended WWTPs'

It was pointed out in the previous sub-section that none of the ViK's operates a WWTP in the Maritza River Basin, and that the only ViK within the priority towns with a WWTP of any description is Stara Zagora ViK. As a result, the interviews and discussions we conducted with the ViK's in respect of the operation of the intended WWTP's were somewhat hypothetical. However, this should not be viewed as a disadvantage as it provides the opportunity for some rationalization at an early stage and does not affect the primary aim of the interview – to review the capacity and capability of the ViKs' to operate and maintain the intended WWTPs'.

The following sub-sections, 2.1 to 2.3 summarize the results of interviews and provide the Team's assessment of the capacity (in view of the proposed plant) and capability (i.e. available skills resources, individual's relevant experience) of the ViK's for Pazardjik, Dimitrovgrad and Stara Zagora. At the end of each of the sub-sections, an objective summary assessment, based on the Team's discussions and findings, is presented.

2.1 Pazardjik

Pazardjik ViK has not been restructured in accordance with the provisions of the Resolution of Parliament of 23 March 1994 approving the World Bank water loan requirements. It is 100% state-owned and has been re-registered under the Trade Act as 'Sole Proprietor Limited Liability Company', and has been renamed Water Supply and Sewerage Ltd, Pazardjik. There are no plans to restructure it during 1998 and no timetable has yet been declared. There appears to be some disagreement within the ViK and Municipalities on the best way to proceed, and this has already led to the break-up of the original ViK. At present, neither the ViK nor the Municipalities want to re-structure and would not provide any official reason for the current stance. However, it is muted that they want to remain in State ownership and so retain eligibility for a grant for the WWTP, they are not interested in a loan.

Previously, there were seven so-called Technical Regions in Pazardjik ViK: Pazardjik, Lesichovo, Septemvri, Belovo, Bracigovo, Panagujrishte and Strelcha. The latter four did not want to remain in State ownership and went their own individual ways (as opposed to a collective, but nevertheless separate way) in July1998. Each is now owned by the Municipality of that name. In the meantime, the three that have remained in state ownership have reorganized themselves into two Technical Regions, with Lesichovo and Septemvri now being combined into one. The proposed new WWTP is to be located in and come under the operational control of Pazardjik.

The current organization chart for Water Supply and Sewerage Ltd, Pazardjik is presented at the end of the Chapter. There are reported to be 250 staff working for the new company. They intend to establish a separate WWTP department within the Company and not place it under the Technical Region. They have no experience in the Company of WWTP operation and don't believe any of their staff do either. The Chief Engineer said that he expects to recruit the necessary staff "from the street", and is confident that "there are plenty of experienced unemployed engineers in the town".

During the course of the services, the Team members responsible for looking into the operational and maintenance aspects met the Managing Director at a first meeting, and the

Chief Engineer at the main second meeting (which included the interview). There seems to be a clear difference of opinion between these two key people as to the direction that the Company should take. It is our opinion that the Water Supply and Sewerage Ltd, Pazardjik needs to put its house in order and present a common and agreed policy (business plan) before proceeding further. It is also our opinion that this could be quite quickly and easily achieved without causing any undue delay to any future steps. On the basis of the main interview and the information provided, they do not appear to have the capability to operate the new WWTP and should look very seriously at attracting the necessary expertise to the town. From the point of view of capacity, the company is grossly over-staffed and given the correct re-training (including post-commissioning on-the-job training) should fill most of the positions from within their current staff resources.

The break-up of the original ViK with four of the Technical Regions going their own way was unfortunate. They appear to have been in a weak position from the point of view of physical size, water and other resources that they had to offer the ViK as a whole. Indeed, they appear to have been a net beneficiary of the original larger ViK, although only on a small scale. The current Water Supply and Sewerage Ltd company appears pleased to have disposed of these Technical Regions, although this fragmentation is unfortunate and should be reversed for the (environmental) benefit of the region as a whole in the long run.

The current organization structure of Pazardjik is shown in Fig. I.2.1.

2.2 Dimitrovgrad

Dimitrovgrad ViK was the first of the three priority towns to be restructured (in August 1996) and is currently 51% state owned and 49% municipality owned. At present there are no plans for the second phase restructuring which would, in theory, see the remaining 51% of the ViK transferred to the respective municipalities. Dimitrovgrad is the smallest of the ViKs included in the Feasibility Study and only has one Technical Region as it serves only one Municipality, although it is sub-divided into the town of Dimitrovgrad and 25 villages.

The organization chart for this ViK appears at the end of the chapter. At present, the Dimitrovgrad ViK employs some 130 staff. They have not yet reviewed in detail their

options for operating a future WWTP, although they stated that they would probably establish the new WWTP as a separate unit under the 'Chief Engineer. Based on the existing Vodokanal design and projection for the number of people to staff the new plant, Dimitrovgrad ViK said that they would expect to employ an additional 80 staff to operate it. However, they pointed out that construction started on the original plant in 1984, although work stopped some 8 to 10 years ago and the design is now obsolete.

The Manager of the Dimitrovgrad ViK claims that they have two WWTP engineers who are currently working on the water treatment plant who they would like to re-train and use at the appropriate time. They are at present restructuring the ViK labor force to encourage a more positive work ethic and motivated approach. They believe that their staff are well trained and motivated, and would look to rationalize their personnel as much as possible through involvement in the WWTP, although they recognize that they will also need to recruit new staff.

On the basis of the interviews conducted with the Manager and the Chief Engineer, and the information provided, Dimitrovgrad ViK appear to have the right approach to operating the new WWTP but do not have the experience or real expertise. It must, therefore, be concluded that they do not at present have the capability or capacity to operate the new WWTP. However, in spite of being a relatively under-funded ViK, they have the drive and ambition to succeed, have a firm set of priorities and know what they want to achieve, although they may not know how to achieve it.

The current organization structure of Dimitrovgrad is shown in Fig. I.2.2.

2.3 Stara Zagora

Stara Zagora ViK was restructured in May 1998 and is currently 51% state owned and 49% municipality owned. At present there are no plans for the second phase restructuring which would, in theory, see the remaining 51% of the ViK transferred to the respective municipalities. Unlike Pazardjik, Stara Zagora ViK has made efforts to retain all its original Technical Regions, no matter how small, in the newly restructured company, and has succeeded. Of the three priority towns included in the Feasibility Study it is easily the

largest and the most forward thinking and is comprised of 10 Technical Regional Regions: Bratia Daskalovi, Chirpan, Galabovo, Kazanlak, Maglish, Opan, Pavel Bania, Radnevo, Stara Zagora and Topolovgrad.

As noted in the previous sub-section, Stara Zagora ViK has two operating treatment plants in its ViK, although neither are in the Maritza River Basin, and a third one in Kazanlak which is nearing completion. The organization chart for this ViK appears at the end of the chapter and clearly shows how the existing WWTPs' fit into the overall organizational structure. In common with the arrangement for the existing WWTPs', the ViK intend to establish the new WWTP as a separate unit under the existing Stara Zagora Technical Region and expect to employ an additional 200 staff to operate it, although it was pointed out that this figure includes the sewerage personnel – both the current staffing and new ones. At present, the Stara Zagora ViK employs some 750 staff.

The General Manager of Stara Zagora ViK said that they intend to use the existing laboratory and mechanical workshop currently set up for the water supply and the existing Radnevo municipal WWTP for the new WWTP. The Radnevo WWTP is a percolating filter plant with a reputed design flow of 70l/s (although this is currently estimated to be only 35l/s) and is operated by 5 personnel. The WWTP at Pavel Bania, which was visited by the Team and the staff interviewed, is an activated sludge plant which is operated by 12 people and presently has a flow to treatment of approximately 27l/s.

On the basis of the interviews conducted with the General Manager of the Stara Zagora ViK, the staff at Pavel Bania and the information provided, they appear to have the capability to operate the new WWTP. Although this expertise is not really available at present in Stara Zagora, they have an excellent platform on which to build – by the time the new WWTP is built they will have three operating plants in the ViK and will have the choice of transferring and additionally training an existing plant manager or recruiting the necessary expertise from another source. From the point of view of capacity, the company is grossly over-staffed and given the correct re-training (including post-commissioning on-the-job training) and proper review of the levels of staffing required to run the new proposed new WWTP, combined with the best scope for efficiency-of-scale savings of all three priority towns, they should be able to fill most of the positions from within their

current staff resources. One final but significant point is that Stara Zagora ViK is a very ambitious, progressive and forward thinking company; they have the will and resources to succeed in the operation of the new WWTP.

The current organization structure of Stara Zagora is shown in Fig. I.2.2.

3 Proposed Organizational Improvements to the ViKs

The ViKs' are over-staffed and inefficient, particularly below the managerial level. As noted above, this is undoubtedly a throwback to the previous centralized system of governmental control practiced in Bulgaria where standardization and jobs for all were the primary aims, and efficiency and productivity were not considerations. This is demonstrated by the current levels of staffing in the existing WWTPs and the proposed levels for the new ones. It is also clearly demonstrated in the ratio of ViK employees per thousand head of population served where, following a recent reduction in staff, the current ratios are still running at approximately 1.5 for Pazardjik, 1.8 for Dimitrovgrad and 1.8 for Stara Zagora. This is without the additional staff required to run the new WWTPs: if Vodokanal's staffing estimates are factored in, the ratios become 2.1, 2.3 and 2.9 for Pazardjik, Dimitrovgrad and Stara Zagora respectively.

These staff ratios are, from a commercial point of view, unacceptably high, particularly when compared to the average ratio of approximately 0.63 employees per 1000 head of population served in the UK for a privatized utility providing *both* water supply and sewerage (collection, treatment and disposal) services, or the conservative estimate of less than 1 employee per thousand people served observed in a well run public or private utility company around the world. For smaller water supply companies (as opposed to the larger privatized utility companies) in the UK, this ratio drops to an average figure of 0.5 employees per thousand people served.

Although it is recognized that many operations are still done manually in Bulgaria, with a ratio of employees per thousand people served between 3 and 4 times higher than in the UK (or 2 to 3 times globally), it is clear from the organization charts that there is a lot of room for staff optimization.

3.1 Pazardjik

Operation and maintenance of the proposed new WWTP will require the formation of a new department within the Water Company and will need to be fully staffed with new people. In order for this to be successful, the reorganization of Water Supply and Sewerage Ltd, Pazardjik must be combined with the acceptance of a realistic level of staffing for the WWTP which corresponds with the preliminary design presented in this feasibility study.

In the context of organizational improvements to enable the sustainable operation of the proposed new WWTP, a new wastewater division should be created which should be subdivided into WWTP and Sewerage System. The WWTP side would be responsible for the sewage treatment and disposal (including effluent, sludge, screenings/grit) and the Sewerage System would be responsible for collection. Common elements, such as pumping station operation and maintenance, should be assigned to one of the sub-divisions but would work in both as required. The WWTP Division should share a common base to ensure maximum interaction and effective use of common resources; this location should be the new WWTP. The organization chart showing the proposed revisions is presented at the end of this Chapter, although it is once again pointed out that the revisions shown are the minimum necessary to establish and operate the WWTP and do not include a restructuring of the entire Company.

With respect to staffing the new WWTP, the company is grossly over-staffed and given the correct re-training (including post-commissioning on-the-job training) should seek to fill most of the positions from within their current staff resources, with the exception of the WWTP Manager, who may need to be recruited from outside the region as an experienced individual is required for this position. Assuming that the appropriate basic skills are available within the Company at present and that realistic staffing levels are applied, this recruiting and re-training from within will be a valuable first step in restructuring the Company. The exact level of staffing required for the new works can not be precisely determined at this time as the level of automation has not been agreed. However, we have indicated on the revised organization chart a total of 27 staff to operate and maintain the

new WWTP; we still consider this figure to be on the high side, but for now it represents a balance between automation and levels of staffing.

The proposed organization structure of Pazardjik is shown in Fig. I.3.1.

3.2 Dimitrovgrad

Operation and maintenance of the proposed new WWTP will require the formation of a new wastewater division within Dimitrovgrad ViK and will need to be fully staffed with new people. With respect to the implementation of organizational improvements to enable the sustainable operation of the proposed new WWTP, this new wastewater division should be divided into WWTP and Sewerage System sub-divisions. The WWTP side would be responsible for the sewage treatment and disposal (including effluent, sludge, screenings/grit) and the Sewerage System would be responsible for collection. Common elements, such as pumping station operation and maintenance, should be assigned to one of the sub-divisions but would work in both as required. The WWTP Division should share a common base to ensure maximum interaction and effective use of common resources; this location should be the new WWTP. The organization chart showing the proposed revisions is presented at the end of this Chapter.

Dimitrovgrad ViK is presently over-staffed. They should seek to fill most of the positions for the new WWTP from within their current staff resources, with the exception of the WWTP Manager, who may need to be recruited from outside the region as an experienced individual is required for this position. Assuming that the appropriate basic skills are available within the Company at present and that realistic staffing levels are applied, it should be possible to re-train the existing staff (who are reported to be highly motivated) and fill most of the positions. This recruiting and re-training from within will be a valuable first step in restructuring the least efficient ViK of the three priority towns. The exact level of staffing required for the new works can not be precisely determined at this time as the level of automation has not been agreed. However, we have indicated on the revised organization chart a total of 19 staff to operate and maintain the new WWTP; we still consider this figure to be on the high side, but for now it represents a balance between automation and levels of staffing.

The proposed organization structure of Dimitrovgrad is shown in Fig. I.3.2.

3.3 Stara Zagora

As previously stated, Stara Zagora is the biggest of the three priority towns and currently has two WWTPs in operation, with a third due to come on line in 1999. In the context of organizational improvements to enable the sustainable operation of the proposed new WWTP, a new regional Wastewater Treatment Division should be created. The Wastewater Treatment Division would be responsible for the sewage treatment and disposal (including effluent, sludge, screenings/grit) at all four WWTPs. The structure of the ViK with regard to the sewerage systems in each of the Technical Regions would remain as they are at the moment: although we do not believe the current arrangement to be the most efficient and that there would be great efficiency gains by creating a regional Sewerage Network Division, this is beyond the limit of this study. The Wastewater Treatment Division should be centrally located at the new WWTP to ensure maximum co-operation, interaction and effective use of common resources. As many services as possible which are common to all the plants should also be centralized here, such as workshop, laboratory, vehicles etc, and consideration should be given to centralizing some of the staff functions, such as mechanical and electrical maintenance teams. The organization chart showing the proposed revision is presented at the end of this Chapter.

Even though Stara Zagora ViK is the most progressive of the priority towns, it is still grossly over-staffed. They should seek to fill most of the positions for the new WWTP from within their current staff resources (although re-training will be required) with the exception of the WWTP Manager, who may need to be recruited from outside the region as an experienced individual is required for this position. Assuming that the appropriate basic skills are available within the Company at present and that realistic staffing levels are applied, especially for the Kazanlak plant and the proposed new WWTP, this recruiting and re-training from within will be a valuable step in restructuring the Company. As in the case of Pazardjik, the exact level of staffing required for the new works can not be precisely determined at this time as the level of automation has not been agreed. However, we have indicated on the revised organization chart a total of 38 staff to operate and

maintain the new WWTP; we still consider this figure to be on the high side, but for now it represents a balance between automation and levels of staffing.

The proposed organization structure of Stara Zagora is shown in Fig. I.3.3.

4 Operation and Maintenance

This section of the Chapter will concentrate on the organizational and staffing aspects of the operation and maintenance (O&M) of the proposed WWTPs for the three priority towns, and not the physical aspects such as the regularity of mechanical plant inspections and checking oil levels, etc. It will review the present approach to O&M of the ViKs in Bulgaria in general and that of the three priority towns in particular, and make broad recommendations as to the future requirements of the three towns in the context of operating and maintaining the proposed new WWTPs.

4.1 Present Approach to O & M

As stated previously, based on the interviews conducted by the Team, their site visits, existing knowledge of current practices and current information, it is clear that all the ViK's are over-staffed and inefficient. This permeates all areas of the ViK, including WWTPs – both the existing ones and those under construction/planned. There are no incentives for the staff and motivation is generally poor, therefore performance and productivity is poor.

The smaller WWTP's are isolated, not just geographically but operationally/professionally. They and their staff are basically left to fend for themselves. It is only the conscientiousness of some of the staff that maintain the appearance of an operating plant, and this has more to do with pride than any ViK-provided incentive or motivation.

All WWTPs, no matter how small, operate 24 hrs per day and have a shift system. This shift system seems to be standard across all WWTPs, but is highly inefficient. The input for one person is 12 hours on (day shift), 24 hours off, 12 hours on (night shift), 48hours off, 12 hours on (day shift), etc. The provision of one operator 'position' around the clock requires a minimum of 4 or 5 staff

In-country experience and individual understanding of sludge handling, conditioning/treatment and disposal is low outside the major (i.e. Plovdiv or Sofia) works, as one would expect.

WWTP operation efficiency is generally poor on the smaller works and not much better on the larger ones. Although the staff do the best with what they have, the smaller works are discriminated against in terms of spares, chemicals, etc. Equipment supplied to WWTP's throughout Bulgaria is basic and inadequate – gloves and a jacket/protective clothing is all. There are no gas detectors, breathing apparatus, explosion proof portable lights, etc. It would be unfair to say that the current level of operation of the works is affected by inadequate, inappropriate or non-existent training, as the people are resourceful (particularly on the smaller works) and do the best with what they have. Operational problems are more to do with poor design and plant inefficiency than poor operators (clearly though, all would benefit from more training and less isolation) or organization. At present the operating deficiencies of the WWTPs' pass largely unnoticed because they are masked by a very weak influent to the plants. However, there will be problems when 'normal' strength sewage arrives at the plants for treatment if appropriate measures are not taken soon.

Problems with maintenance contribute as much to the poor performance of the WWTPs as does the poor design. On all the smaller WWTP's maintenance is a reactive exercise. Planned preventative maintenance is not even an option due to lack of spare parts and funding. Minor routine maintenance (e.g. lubrication) and some essential tasks, such as maintaining the correct level of oil in the air blowers, is the extent of it. There is a lack of chemicals in the laboratories at the works for conducting even the most basic tests.

The problems of shortages of even essential spare parts is a serious issue. The smaller WWTPs do not carry any spare parts "on the shelf", with the exception of the occasional pump bearing. If a smaller works needs a spare part it must be ordered through the ViK – more expensive or difficult to acquire items can take years to arrive, if they arrive at all. In the interim, the item of plant that needs the spare stands idle; in some instances this can be an item of plant essential to the correct process operation of the plant, such as an air blower.

The main reason for this is lack of revenue and the (inadequate) make up of the tariff – an issue reviewed at length in sub-section 4.5.6. The larger WWTP's, such as Plovdiv or Sofia, carry some spares and can practice a degree of planned preventative maintenance, although it is still normally reactive. In all instances, however, the general grounds maintenance (i.e. grass cutting) around the works is not good, and neither is the basic maintenance of the structures, walkways and access roads, all of which are generally in need of hosing down.

4.2 Future Requirements for O & M

It is clear that the future sustainable operation and maintenance of the WWTPs is dependent upon improving the operational efficiency of the proposed works from the outset, and the ViK itself. The proposed operational improvements discussed in sub-section 4.5.3 are essential. However, to some degree, it is possible to look at specific measures that can be applied directly to the WWTPs in isolation (i.e. are not dependant on reorganization of the whole ViK) to assist in the successful future operation of the WWTP. These measures, not all of which are applicable to all three priority towns, could include the following:

- centralization of WWTP functions and associated services, including some of the staffing;
- applying realistic manning levels, i.e. more or less to western European levels;
- introducing remote (e.g. telemetry) alarms at the smaller works so 24 hour operator presence is not required;
- using the opportunity of new WWTPs to update safety equipment and operational necessities currently lacking, as well as create an essential spares store;
- reviewing the shift system;
- promoting interaction between staff at the different (particularly the smaller) plants and the network operatives;
- providing incentives and other measures to promote staff motivation;
- providing regular and structured training;
- providing better health and safety measures;
- encouraging selected staff to learn more about the other works in the region so there

is built-in flexibility in the ViK with regard to regional staffing and potential efficiency benefits – potentially more interesting for the operatives too.

A detailed 'Strategic Plan' covering every aspect of the development of the WWTP and the ViK's involvement at each stage and in each aspect of this development, from inception to commissioning and operation (and maintenance), must be developed. The ViK's do not at present have the experience or in-house capability to undertake such an exercise and should seek outside assistance from an experienced water/wastewater operator from western Europe to draw up the Strategic Plan. This plan will assist the ViK's in preparing themselves and their staff for the operation of the works and be a key element in the sustainable operation and maintenance.

There is no real measure of the performance of WWTPs' in Bulgaria. Although the Ministry of Environment occasionally sample the effluent from the WWTP's, there are very few failures because the sewage is so weak. Therefore, there is little incentive for the works to perform. In the future, this will change and sewage strength will increase as new sewers are laid and infiltration to existing ones is reduced. The ViK's should introduce ways of measuring operational performance using appropriate key performance indicators, such as the chemical content of effluent being discharged, chemical content of influent to the works (especially applicable in situations /circumstances where testing and monitoring of industry discharges is important), frequency of breakdowns, etc. Key performance indicators also act as incentives and, for added effect, can be tied to key objectives of national strategy.

It is important that the ViKs' are fully aware of what they can expect from the construction of the new works and take advantage of the opportunities that will be available at this time. With the right advice and proper pre-planning (i.e. the strategic plan), they will have the opportunity to operate and maintain the new WWTPs to the right level. The new works will provide the right equipment (in terms of the operating plant and machinery, and the equipment to maintain it), spares, staff training and maintenance requirements. Proper planned preventative maintenance of plant and equipment must be actively practiced. A proper schedule and manual must be produced by the contractor during construction and must be adhered to by the plant management. This should include every conceivable

element of total plant operation and maintenance from annual visual inspections on the integrity of the internal concrete of the primary tanks and scraper blades, to daily operational items such as checking the temperature of the windings on a pump motor.

The majority of the initial cost of the operation and maintenance of the new WWTP will be included in the construction contract. However, the cost of subsequently operating and maintaining the works to the correct level and of retaining the appropriate spare parts and maintenance materials etc in stock will have to be met by the ViK. It is, therefore, essential that the ViK sharpens up its commercial approach to providing water and sewerage services as the money saved in greater staff efficiency, proper allowances in the tariff (see sub-section 4.5.7) and practicing planned preventative maintenance will more than off-set the costs of operating and maintaining the new WWTP.

As noted in the previous sub-section, one of the shortfalls on the current works is general maintenance which, relatively speaking, is inexpensive to practice. General maintenance must be improved, such as grass cutting, cleaning and disinfecting, visual inspections of the assets, etc. Proper logs and accurate records must be kept on plant running times, down time, etc. These are all areas that can be linked to performance indicators and so used to motivate staff to perform.

Two final points to be made in this section are important elements to both the employees and the ViK in the successful and sustainable operation and maintenance of the WWTPs, and must be given the importance they deserve and be implemented; they are:

- regular and appropriate training of all staff from managers to operatives/laborers (this is dealt with in more detail in the following section),
- the establishment and maintenance of proper health and safety procedures.

5 Training of O & M Staff

This section of the chapter will provide an overview of the present approach to training in the ViK's and go on to outline in broad terms the future training requirements for the

O&M staff for ensuring the successful and sustainable operation and maintenance of the new WWTPs'.

5.1 The Present Approach to Training

The present approach to training of WWTP staff does not appear to follow any set pattern and differs from ViK to ViK and works to works. What training there is falls into two categories, safety and technical. The current training practices of the three ViKs' which the three priority towns come under follows below. For comparative purposes, we have also included a brief review of the level of training provided to the staff at the Ihtiman WWTP. Although the team also visited and interviewed staff at the Sofia and Plovdiv WWTPs', their approach to training is atypical and is not reported on here, although they too would benefit from the future training requirements proposed in the following sub-section.

Pazardjik does not have a WWTP, but they apply a general training requirement to their employees. When staff join the ViK they receive initial technical training appropriate to their intended job and training in 'safety', and must pass an exam at the end. Thereafter, it is claimed that they receive a one day safety training course every three months.

Pavel Bania comes under the Stara Zagora ViK and is a small and somewhat isolated works. The plant was commissioned 12 years ago. The mechanical and electrical staff, who are effectively the works operators, were trained in WWTP operation and safety 12 years ago at Stara Zagora (even though there was no WWTP at Stara Zagora) before taking up their positions. These mechanical and electrical staff receive safety training annually which the plant manager conducts at the WWTP. Surprisingly, the plant manager herself has received no formal safety training nor has she attended any 'refresher' courses. In addition, the WWTP laborers receive no training, not even basic safety training.

Dimitrovgrad does not have a WWTP, but, like Pazardjik, they apply a general training requirement to their employees. When staff join the ViK they receive initial technical or practical training appropriate to their intended job and training in 'safety', and must pass an exam at the end. For example, in Dimitrovgrad, the mechanical and electrical staff are

trained in safety and the technical/practical (i.e. hands on) aspects, while the water treatment plant maintenance staff, who evidently operate the WTP, receive training in safety and in chlorination practice.

Ihtiman is part of the Sofia ViK and is a fairly small but well run works. Most of the staff at the works have been there since it was commissioned some 16 years ago. The manager, laboratory technicians, mechanical and electrical engineers all received appropriate training for a period of one year before the original start-up of the plant. Annual training is now given in safety and plant operation to all levels of staff employed at the WWTP, with the exception of the laboratory technicians. This is said to be a 3 day training and refresher course, appropriate to the grade of employee.

5.2 Future Training Requirements for O & M

The level of training should be more uniform between the ViK's. With respect to the particular area of safety training, or more specifically Health and Safety, the legal requirement should be far more prescriptive. Guidelines should be issued by the Ministry of Public Works and Housing, or other appropriate Ministry to ensure that the workers at the WWTPs, the general public at large and anyone else who may come into contact with a WWTP is adequately protected from the associated dangers.

For the new WWTPs', successful and sustainable operation can only be achieved if planned preventative maintenance is practiced. This can only be achieved in practice through the proper structured training of all employees, from the director down to anyone and everyone who will work in or come into contact with the sewers and the WWTPs.

Before looking at the training itself, we must look at the potential trainees. Staff selection for appointment and promotion in Bulgaria is generally based on seniority and a perceived level of technical competence, rather than the matching of candidates skills and competence with pre-defined requirements for the position. This is a poor management practice that must be addressed and corrected so that the best available candidate for a post is awarded that post.

In addition, almost none of the senior management staff we have come into contact with or are aware of have any experience of western European-style management techniques and practices. Bearing in mind the cultural and organizational changes that will occur in the next few years, this is a shortfall that must be rectified through the provision of training in such areas as general management, commercial business management, planning, maintenance and budgeting to those employees of the ViKs' who are seen as the key members of the management team. Even if reorganization of the ViKs' occurs after the commissioning of the proposed new WWTPs', which is not the ideal scenario from the point of view of sustainable operation, having the right senior managers in place with the right training who understand what is required and will act accordingly will be essential.

At the WWTP level, appropriate and adequate training of all the staff from the Works Manager to the laborers is of paramount importance for the smooth and efficient running of the works. As mentioned on a number of previous occasions, the ViKs' are over-staffed, the existing WWTPs' are overstaffed, and the Vodokanal figures for the proposed staffing for the new WWTPs' are excessive – in the order of 4 to 5 compared to a labor-intensive plant in western Europe. One of the main reasons for this level of over-staffing was explained in sub-section 4.5.3 as being a throwback to the previous centralized system of governmental control where standardization and jobs for all was the primary aim. This had the effect of creating staff functions and roles that are, on the whole, very narrowly defined. As a consequence, staff did not operate flexibly across more than one role, other than in very exceptional circumstances. Unfortunately, this attitude/ approach is still prevalent today and is "accepted" as the norm by nearly all employees from senior management/director level to trainee. It is an attitude that is deeply ingrained in the workforce and one that must be replaced by a more flexible work ethic. The provision of good quality, appropriate and structured training will go some way to changing the current attitude, but time and proof through application will be needed to convince employees.

There are many types of training courses for the various grades of personnel involved in the operation of a WWTP and different approaches that can be taken to the training. However, specifying and defining the exact courses and their content involves, in the first instance, a detailed 'Training Needs Assessment' which, at this feasibility study stage, is inappropriate. However, it is appropriate to identify in broad terms the content and form

that the training could take, and to whom (involved in the operation of the works) it is applicable, although at this stage it is only one suggestion.

It is also proposed that training should be carried out on two levels, manager/management and operator. Manager here refers to the WWTP manager (or area manager for the WWTPs, if appropriate) and management refers to senior staff in the ViK, i.e. the Works Manager's 'Line Managers'/superiors. Operator is used as a generic term and is deemed to include the works operators, M & E staff, maintenance personnel, laboratory technicians. However, to ensure the fullest understanding at the manager/ management level, managers will undertake the same training as the operators as well as their own specialized training. It is suggested that additional modules are included to enable selected senior managers/management to receive some training as trainers. Laborers, security personnel and the like are dealt with separately later.

Training for the operation of the WWTP should be sub-divided into two primary areas:

- Introductory and Preparatory Training.
- Specific Training for Operation of the WWTP.

Introductory and preparatory training should take two forms, classroom and workshop. It is intended to give all the staff a grounding in the basics required to operate a works and ensure that they have achieved a uniform minimum standard before the all-important specific training starts. The operators will participate in all the workshops and selected classroom courses. The managers will attend all workshops and classroom courses, this will not only ensure a thorough across-the-board training, but also be appropriate preparation for their future training as trainers.

In brief, the workshops will cover:

- an introduction to the main components to be found in the WWTP, such as pipes and fittings, penstocks, valves, flow measurement devices etc, their function, and how they work;
- routine maintenance on the aforementioned components, repair and rectification of

common faults and problems, replacement, when to call in external/specialist assistance;

- practical demonstrations on safety at the works, safety equipment and safe operating methods/procedures, handling of hazardous materials and waste;
- clearance of blockages to pipes, screens, pumps and chambers etc.

Similarly, for all the staff, the classroom training will cover:

- Background to the wastewater treatment plant project, the importance of treating wastewater, the effect of industrial wastewater, environmental benefits of treatment, etc.
- Introduction to the basic principles of the treatment process involved, the effect of industrial wastewater and the need to monitor and control discharges, and relevant legislation (EU and Bulgarian) governing discharges of (treated) wastewater.
- Introduction of personnel to the basic elements of plant management, as well as the provision of instruction and guidance concerning practical work organization on operating plant.
- Introduction of personnel to practical plant operation, as well as utilization of supporting material, information systems, reporting and control measures/procedures.
- Introduction to general/routine plant maintenance and planned, preventative maintenance.
- Potential operational problems and basic/general emergency procedures (i.e. outline 'action plans' and 'emergency action plans').
- Health and safety at the works.

In addition to the above, the following classroom courses will be held for the managers, although it is recognized that some of the top ViK staff may, by this time, have undertaken specialized management training referred to earlier in this section:

- Management, organization and reporting.
- The economics of plant maintenance and upkeep.
- A preview of the total system operation.

- Further information on the principles of the treatment process involved at the WWTP and throughout the system as a whole.

The classroom-based training and courses should be specifically tailored towards the WWTP and the staff in order to provide, as far as possible, a relevant yet flexible approach. Appropriate course notes should be provided for all the above courses and workshops. It is intended that the above 'Introductory and Preparatory Training' is conducted by an external (international) consultant or operator experienced in this type of training. It is also intended that training will be provided by the WWTP contractor (covered later in this section), and that there may be some degree of overlap between the external consultant's course and the contractor provided training.

The second primary area of training, 'Specific Training for Operation of the WWTP' would be intended to provide detailed and in-depth training and should be provided by the Contractor. It should concentrate on the actual plant and equipment provided, the specific operating procedures, instrumentation and control, actual emergency scenarios/procedures, the actual maintenance requirements, etc. It should be based on and work through the contractor's Maintenance Manual for the WWTP and combine hands-on experience at the plant, additional (contractor-provided) workshop training, and classroom training.

It is strongly recommended that the external (international) consultant who conducted the 'Introductory and Preparatory Training' reviews the contractor's detailed training proposals before the training commences, and then closely monitors the training as it progresses to try and ensure a consistent and appropriate standard of training, and provide a coordinated holistic approach.

In the WWTP Tender Document, contractors *must* be instructed to provide detailed proposals for the training they propose, which as a minimum, should fall within the following guidelines:

- Timing of the training, which must be conducted within the erection and commissioning period.
- The design standards and procedures adopted.

- The relevant quality assurance procedures to be adopted for design and monitoring, and the effluent quality control procedures to be proposed.
- Keeping of plant records, metering of wastewater influent and effluent flows.
- The operational methodology and preventative maintenance procedures.
- Hands-on operation of the various items of mechanical and electrical plant and equipment.
- Emergency scenarios and procedures, i.e. action plans for emergency incidents.

It is recommended that the WWTP contractor is required to provide a period for monitoring and assisting of the WWTP operatives after commissioning and hand-over of the plant to the ViK.

The 'Specific Training for Operation of the WWTP' must also include the so-called 'Operational Tasking'. Operational Tasking includes the setting up at the WWTP of purpose-designed operational records systems, operational procedures (either to complement those previously laid down by the contractor in the O & M manual or to provide additional ones), and planned maintenance procedures. Record systems can either be set-up as computer-based or manual. Initially, a manual system would be more workable, but a final decision can be taken at a later stage. The Operational Tasking can be set-up by either the external consultant or the contractor; if it is set up by the contractor, the external consultant should monitor it. Operational Tasking must be in place prior to commissioning and, ideally, should be programmed to overlap with the contractor provided training, and then continue into the contractor's monitoring period after hand-over. This will allow sufficient time to confirm that the systems are appropriate and give the operators' time to implement and familiarize themselves with the systems, and give them the confidence to operate the WWTP.

6 Water Supply Revenue System and Cost Recovery

6.1 Current Practices in Water Supply Revenue System and Cost Recovery

Tariff Setting Mechanism, Components & Approval

The legal basis for the setting of tariffs by the ViKs' is the "Methodology for Setting of Water Tariffs" issued by the Council of Ministers with Decree No 98 of 29 April 1998, and published in State Gazette 40/1996. The Methodology is (legally) based on the Law on Prices and Rules for Implementation of the Law on Prices, Accountancy Law, Water Law, National Account Plan, National Accountancy Standard, and Regulation No 9 for "Use of Water Supply and Sewerage Systems", promulgated in State Gazette No 77/1994. Relevant key points of the Methodology are set out below.

- The Methodology deals with the price of potable and non-potable water supply, and the collection and treatment of wastewater. There is no mention of disposal of either effluent, sludge or grit and screenings.
- The tariff setting method is based on the "cost plus" principle. In other words, in the case of water supply, the price of 1m is determined on the basis of full costs for extraction, treatment and supply, plus a profit margin (Article 3 (1) of the Methodology).
- The allowable level of the profit margin is up to 12% of the costs if there is no investment program, and could be as much as calculated to cover the costs for an investment program related to rehabilitation of water supply and sewerage networks, and rehabilitation and upgrading of facilities (Appendix B to Article 11 of "Rules for Implementing the Law on Prices"). New facilities are not specifically mentioned but are, apparently, deemed to be included.
- Investment programs are approved by the Minister of Regional Development and Public Works for companies with more than 50% state ownership and by the respective Municipal Council for municipal companies.
- Full costs for one calendar year are determined on the basis of the reported full costs for billed water for the previous year and the projected costs for the next year.
- The volume of water expected to be sold is determined on the basis of water billed for the last three years and the projected volume for next year.
- Prices can be uniform for all the regions under one water company, but are allowed to differ if the supply is different, i.e. gravity or pumped water. (Article 14 of the Methodology).
- There are two categories of clients: the first category is the so-called 'population' (i.e. the public at large) and 'budget institutions' (i.e. ministries, schools, hospitals, etc.)

for whom the pricing is the same, and the second is industry with a higher price. The lower price for the first category is for two reasons; (1) population and budget institutions are VAT exempt, and (2) water supply charges are calculated with a lower electricity price under this category.

- Billing is done on a monthly basis for both categories of consumers.
- Meters are read monthly for legal entities (companies) and periodically (periods not to exceed 3 months) for population (Article 26 of Regulation No 9).
- Non-metered water is determined and charged on a fixed monthly basis as follows: (a) 10 m for centrally heated and 7 m for non-centrally heated properties per registered inhabitant; (b) 15 m for each 100 m or for part of 100 m of arable land; (c) 0.1 m per m for seasonally used properties (cottage, bungalow etc.) and properties without registered inhabitants; (d) 5 m per m for buildings under construction (Clause 5, Article 30 of Regulation No 9).
- According to Order No 20/1997 of MRDPW each consumer is required to install a water meter by the end of 1998.

The water tariffs consist of the following three components, as applicable:

(i) water supply;

(ii) wastewater collection, and

(iii) wastewater treatment, including sludge disposal (if there is a treatment plant).

Each component is determined on the basis of separate calculations of expenditures for the activity, expected volume of water to be supplied and wastewater to be collected and treated. For example, a typical break down of the water tariff into these three components in the service area of ViK Sofia is as follows:

Consumers	Population & Budget Institutions	Industry
Water supply	65 %	60 %
Wastewater collection	10 %	10 %
Wastewater treatment	25 %	30 %

Particularly relevant to this section of this Feasibility Study is the operation and maintenance aspect of the costs/tariff for the WWTP which, as indicated above, are

budgeted and calculated as a specific component of the water tariffs by the ViK's. There are no government subsidies or cross-subsidies. Some key points relating to the O & M costs for wastewater are given below.

- Wastewater is not metered, but is estimated empirically as a percentage of the water billed and varies in the different regions; for ViK Sofia this figure is 95% of drinking water billed.
- Treated wastewater is also estimated as a percentage of wastewater billed; i.e. for ViK Sofia this is about 95 %.
- The price for treating 1m of wastewater is determined on the basis of full costs for treatment plus a profit margin;
- 'Population' and 'budget institutions' pay a price which is linked only to the volume of potable water billed. In some ViKs 'population' does not pay for wastewater treatment, though the plants exist - the costs for treatment are usually born by the industry.
- The charge for 'industry' varies according to the volume of potable water billed and the pollution loading of the effluent, as follows: (1) BOD_5<200 mg/l; (2) BOD_5 200 to 600 mg/l; (3) BOD_5 > 600 mg/l;
- The cost of treating wastewater and the apportionment of those costs between the different categories of customer depends on the type of region (industrial, rural, residential) and availability of WWTP; below is an example for ViK Sofia where population is the major consumer with about 65% of the water consumed.

population		65%
budget institutions		11%
industry	(1)BOD_5	20%
	(2)BOD_5	2%
	(3)BOD_5	2%

- "Capital maintenance" for WWTP equipment (i.e. the cost of major items required for maintenance) is not recognized as an expenditure that can be included in the overall water supply tariff and that can be passed on to the customers. At present, capital maintenance items are funded by separate loans from one of the ministry's budgets for which the ViK must submit an application.

The main conclusion that can be drawn from the above points concerning O & M costs for wastewater collection and treatment is that whereas the costs for operation are, in theory at least, fully covered through tariffs, the maintenance costs are not. Not only are the "capital maintenance" costs not recovered, but there is no understanding of the true cost of maintenance at a WWTP, or even what items should be included and costed for as maintenance programs don't exist.

Like the investment programs, tariffs are subject to approval by the Ministry of Regional Development and Public Works for companies with more than 50% state ownership and by the respective Municipal Council for municipal companies.

Cost Recovery

The following costs are recognized as expenditure according to current legislation and can be recovered through tariffs:

- materials (chemicals and spare parts for repair of tangible assets);
- energy costs and fuels;
- external services (for maintenance and repair of buildings, facilities, equipment, vehicles etc. usually done by external firms);
- depreciation (on tangible assets, the allowance against which is calculated in accordance with Accountancy Act);
- salaries;
- social security charges;
- others (vocational qualification and unemployment, business trips, participation in exhibitions and fairs etc.);
- supporting activities (transport, laboratories etc.);
- organization and management;
- "realization" (billing & collection, maintenance of office equipment, insurance, rent for premises etc.);
- financial (100% of the interest charged on loans and securities).

There are a number of deficiencies in the current cost recovery mechanism, the most prominent of which are summarized below:

- Inadequate allowances for depreciation (from the Accountancy Act) and amortization;
- Capital investment – repayment of the capital element of a loan used for acquiring fixed assets is not recognized as a tax deductible expenditure;
- Capital maintenance for wastewater treatment equipment is not recognized as an expenditure that can be included in the tariff.

Non-Revenue Water (NRW)

NRW is an important performance indicator on the water supply side of the ViK's and, of course, directly related to the level of O & M cost recovery for the WWTPs. The (official) situation observed in the last five years in Bulgaria shows that the average overall NRW, expressed in percentage of the total production, is about 55 %. NRW is attributable to a number of causes, usually defined as physical and non-physical (or institutional) losses, such as:

(Physical losses)

- leakage from the distribution system;
- leakage or overflow from tanks and service reservoirs within the system;

(Non physical losses)

- unrecorded consumption and illegal or unregistered connections to the system;
- under registration of customer meters;
- over registration of source meters or over estimation of volumes put into supply;
- legitimate unrecorded water use.

The amount of NRW that can be attributed to the above causes varies from ViK to ViK. The reason for this variation is, to some degree, dependant on the degree of urbanization/ruralization, number of high-volume water user industries, as illustrated in the paragraphs below.

Under-recording is a matter of particular concern in the case of the big consumers. Due to the reduction in consumption most of the meters of the industries or other large users became oversized and are at present estimated to be under-metering. This is an area of particular concern to, for example, Stara Zagora ViK, where 30% of the overall potable water consumption comes from only 30 major consumers. The records of their consumption for the last five years show some discrepancies which affect the proper billing. Similar situations have been observed at other ViK's throughout Bulgaria where industries are a large consumer.

Continual rise of the water tariffs, during the last years, has not been in parallel with the increase in income of the average household. This situation has most certainly encouraged an increase in the number of illegal connections. Another issue, which is difficult to monitor, is the use of piped water in rural areas for irrigation of private holdings, again often by illegal connections. This is typical for the summer and it is a major problem faced by most of the ViK's in Bulgaria, but particularly those with large rural populations.

Some ViK's estimate their non physical losses in the range of 50% to 70% of the total losses. Others, such as Plovdiv, may have non-physical losses as low as 26%; in other words Physical losses in Plovdiv could be as high as 74% which, in a system with an average regional NRW of 62%, is very (unacceptably) high.

6.2 Considerations for Future Changes in Water Supply Revenue System and Cost Recovery

It is clear that full cost recovery is essential if the WWTPs, which are the subject of this feasibility study, are to be successfully and sustainably operated and maintained.

Clause 33, Article 2 of the Proposal for EU Framework Directive in the Field of Water Policy (COM(97) 49 final - 97/0067 (SYN)) defines "full cost recovery" as meaning that the following cost elements of any services provided in relation to water use are paid by the user through prices or charges:

- Operation and maintenance costs;
- Capital maintenance costs;
- Capital costs (capital element (principal) and interest payments);
- Reserves for future improvements and extensions.

Although it is noted that exemptions may be granted for the following reasons:

- in order to allow the basic level of water use for domestic purposes at an affordable price;
- in order to allow the capital cost subsidies for infrastructure projects which are designed to assist in the achievement of specific environmental objectives;
- in order to take account of a specific geographical or climatic situation of a region.

There are a range of measures to be considered in respect of future changes in the water supply revenue system and cost recovery. Some of these considerations are fundamental and require changes to the laws and/or regulations currently in force in Bulgaria, others require action from the ViKs, while there are some issues that can be addressed at 'WWTP' level. While the context of this part of the feasibility study is the sustainable operation of the WWTPs' in the three priority towns, it is inevitable that we will touch on the larger issues, particularly when looking at cost recovery and revenue systems. It is pointed out that the following list is not intended to be comprehensive or detailed list of recommendations, but suggestions made in line with the preceding text.

- Full cost recovery, as defined above, must be achieved, and the Government and ViKs must start implementing the necessary direct and supporting measures immediately.

- Improvement in non revenue water losses through specifically addressing the major points.

- Increase the allowances for depreciation and amortization of the ViK assets.

- Repayment of the capital element of a loan used for acquiring fixed assets or any

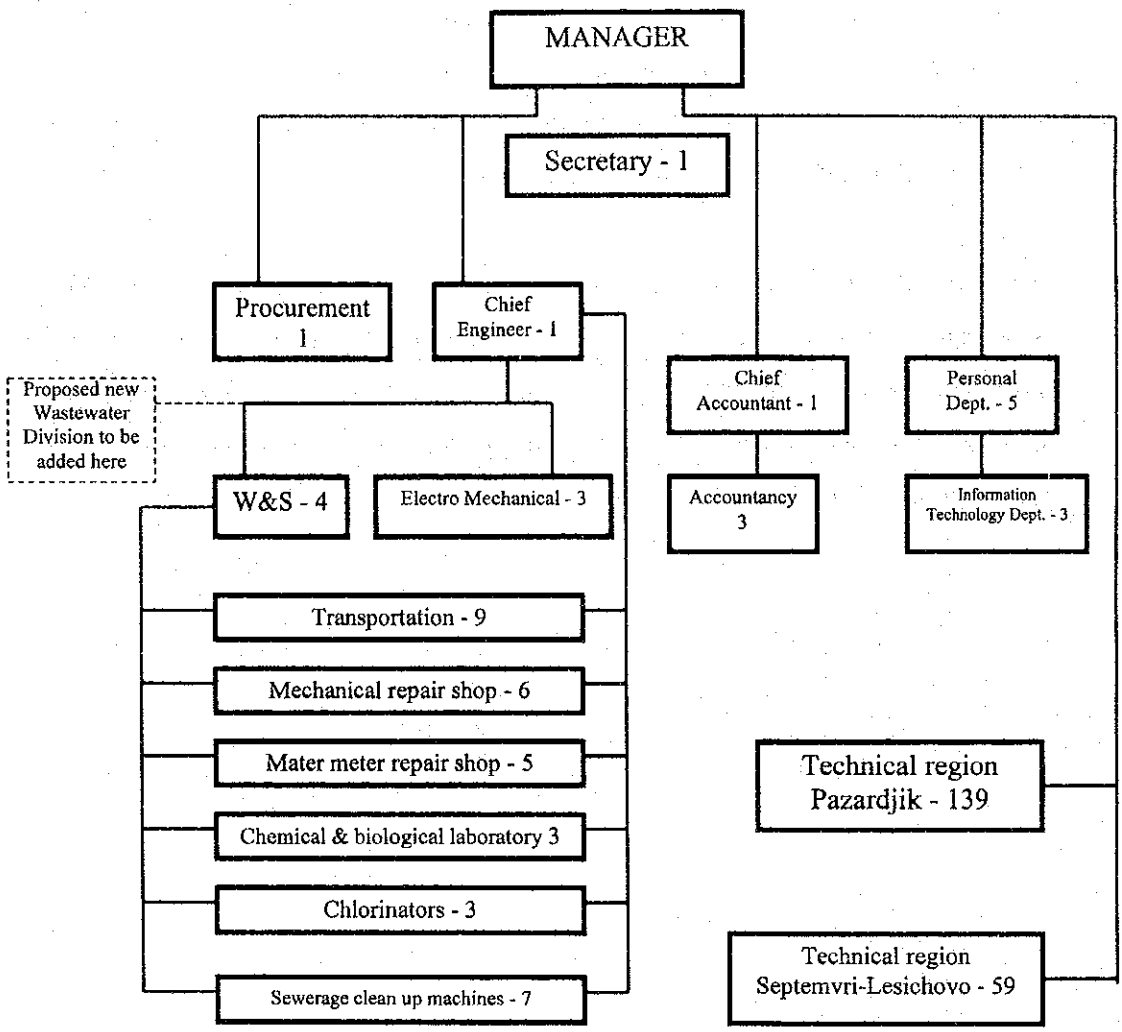
other major capital expense necessitating a loan should be recognized as a tax deductible expenditure.

- Capital maintenance for WWTP equipment should be recognized as an expenditure that can be included in the tariff.

- Increase the presently allowable 12% "profit margins" added to the cost of supplying and, where applicable, collecting and treating wastewater to a more realistic figure that allows for realistic future levels of sustainable investments by the ViKs to be achieved, although clear principles and rules must be established.

- The true cost of operating and maintaining a WWTP to ensure the correct and sustainable operation and maintenance of the facility must be determined and provided. This should include, as a separate and specific item, the treatment and disposal of sludge, screenings and grit with due consideration for both the short-term and medium/long (i.e. EU) requirements.

Current (at Oct. 1998) Organizational Structure
For "W&S" Ltd. Pazardjik
(Prepared by W&S Ltd.)



Total number of personnel - 253

FIG.I.2.1 CURRENT ORGANIZATION STRUCTURE OF PAZARDJIK WATER SUPPLY AND SEWERAGE COMPANY

Current (at Oct. 1998) Organizational Structure
For W&S Company Ltd. DIMITROVGRAD.
(Prepared by W&S Co Ltd.)

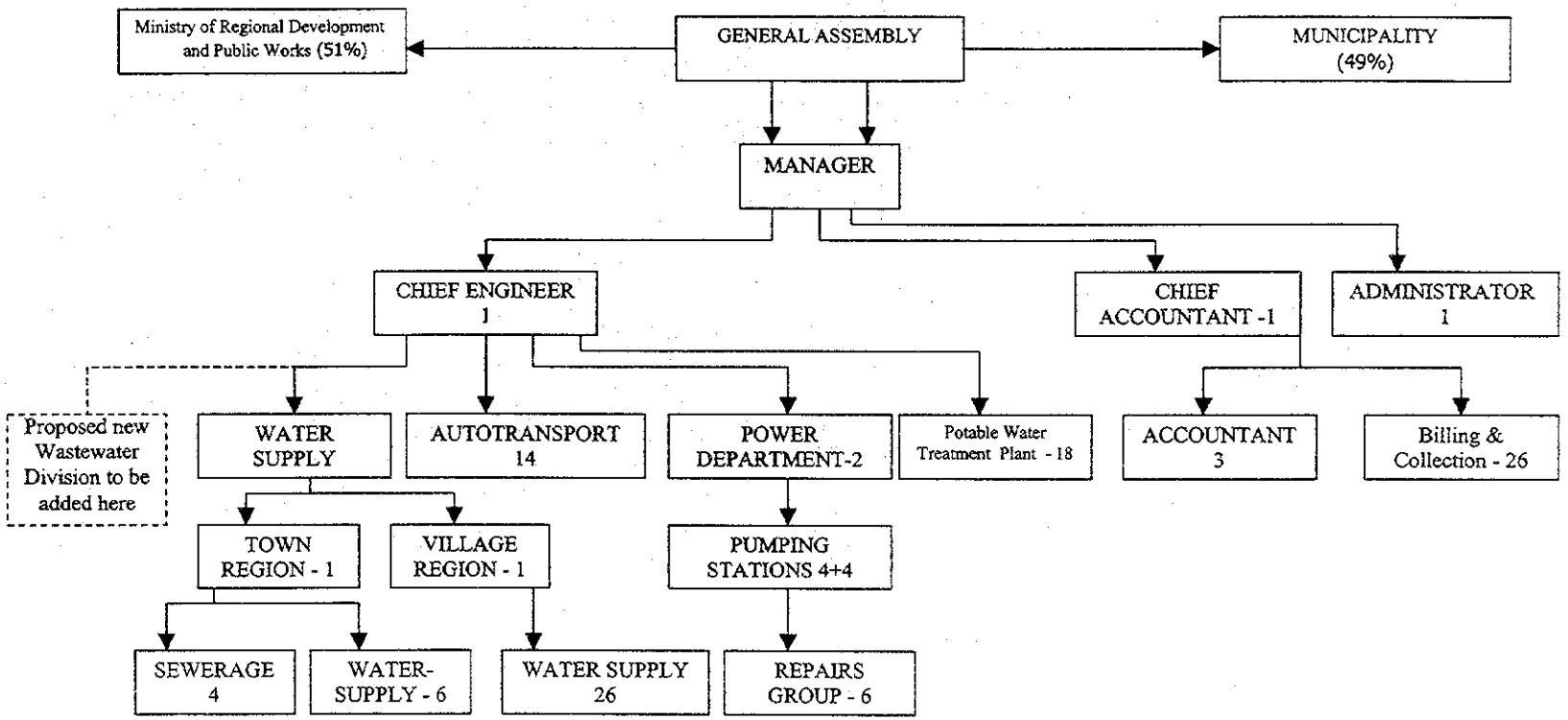


FIG.I.2.2 CURRENT ORGANIZATION STRUCTURE OF DIMITROVGRAD WATER SUPPLY AND SEWERAGE COMPANY

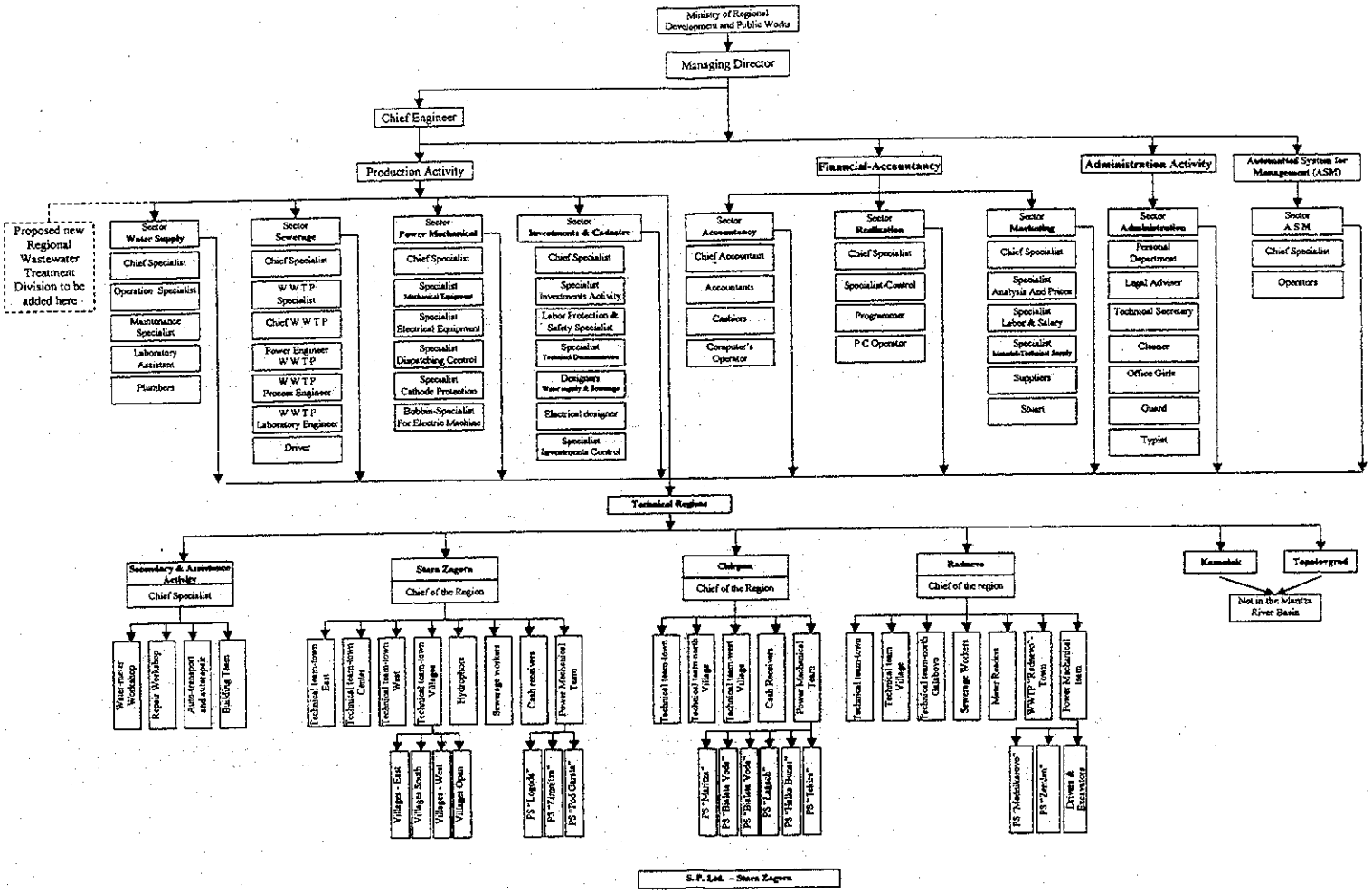
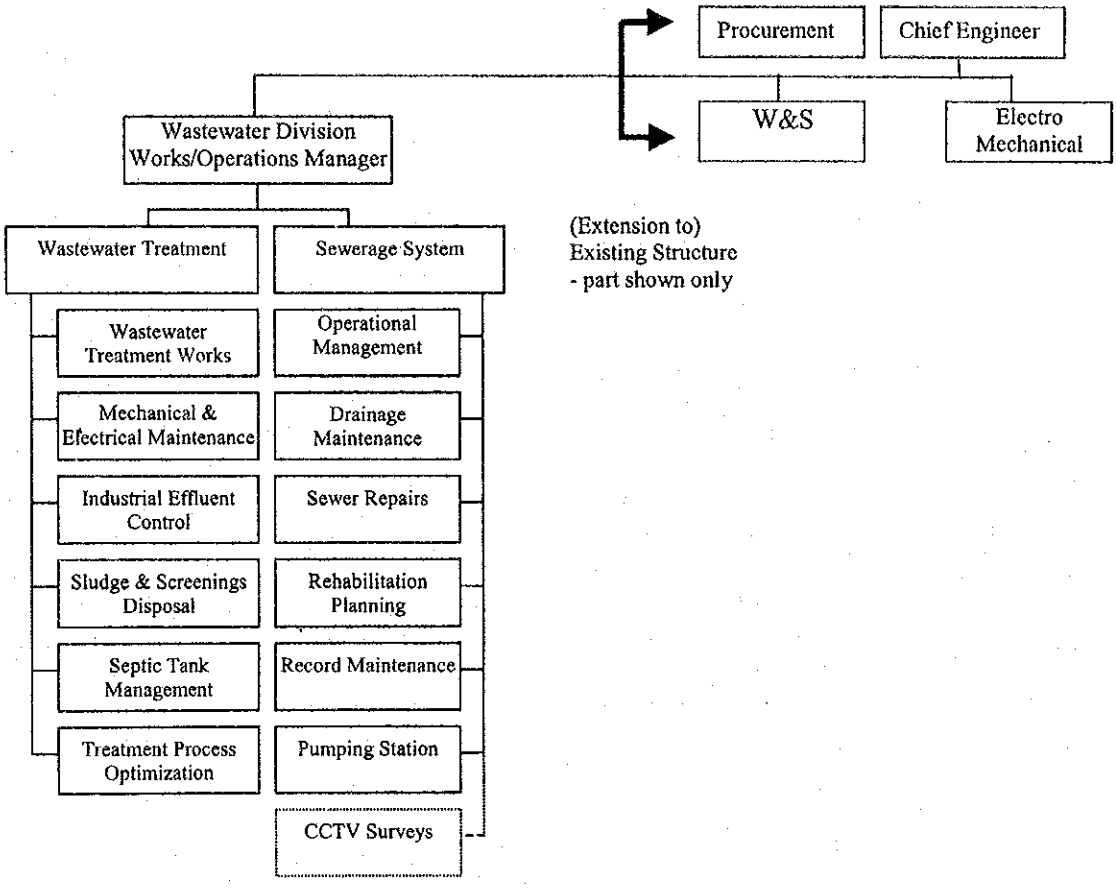


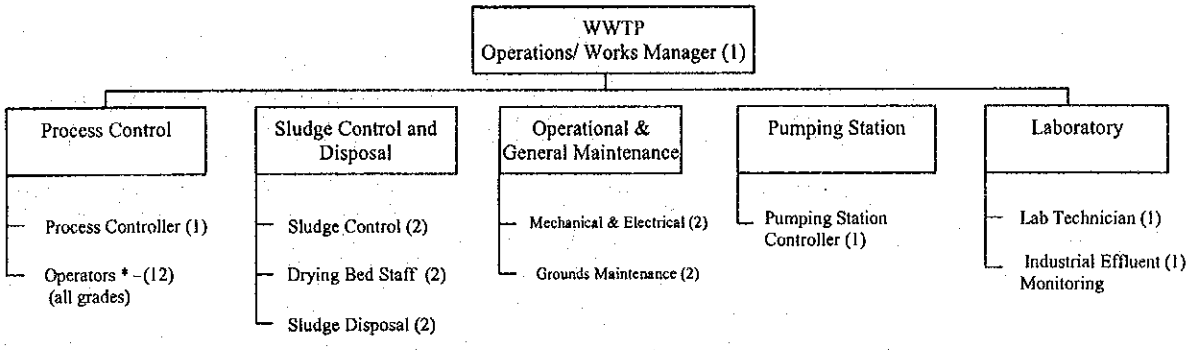
FIG.I.2.3 CURRENT ORGANIZATION STRUCTURE OF STARA ZAGORA WATER SUPPLY AND SEWERAGE COMPANY

Proposed Organizational Improvements to Facilitate Operation of the New WWTP at Pazardjik (Part Diagram – Refer to Existing)

(1) Operation Division Structure



(2) Indicative WWTP Operation

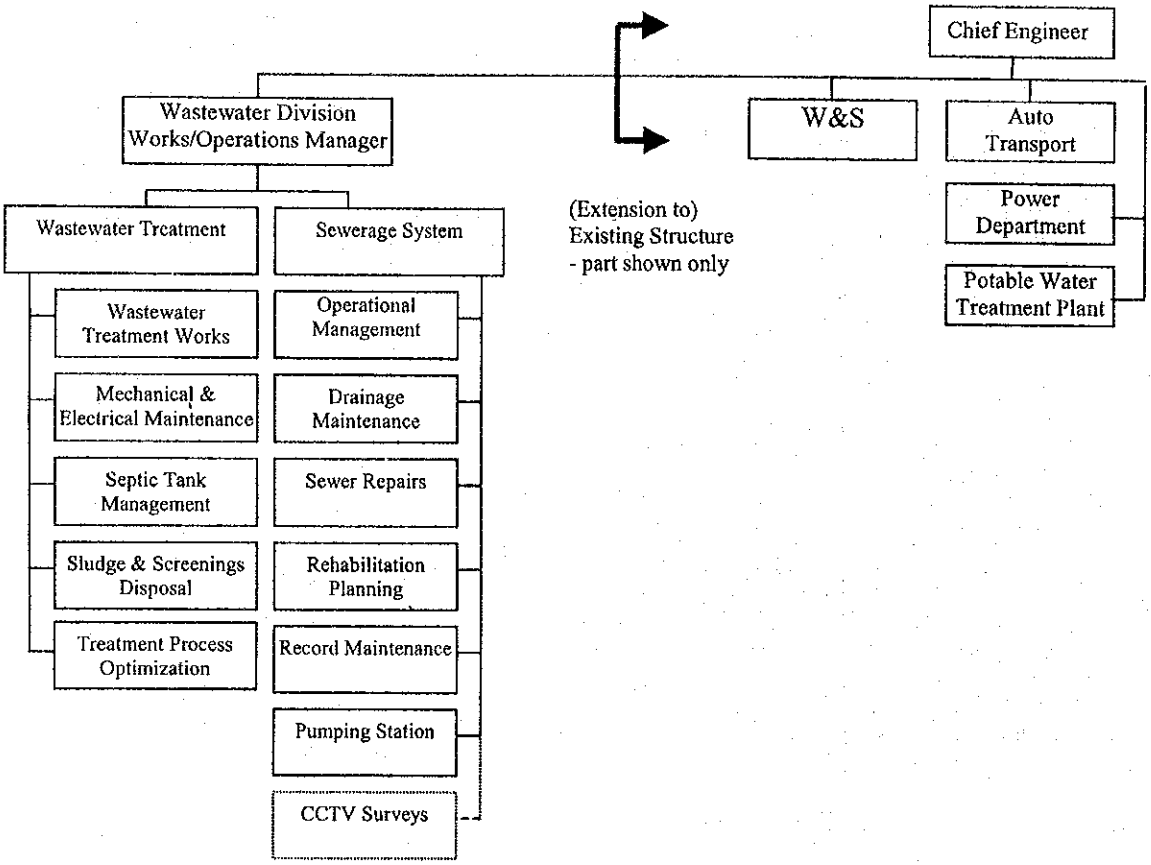


Note: * It is noted that in Bulgaria, operators are often normally M&E trained personnel. The term "operator" above, is therefore a generic term and includes different levels of operator.

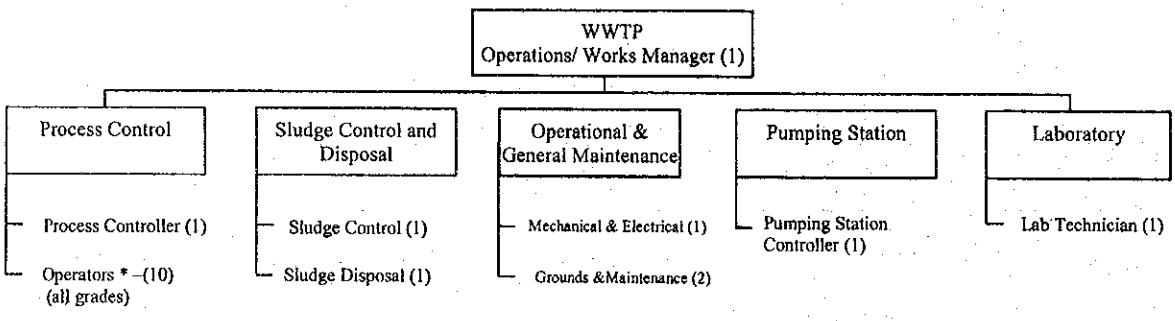
FIG.I.3.1 PROPOSED ORGANIZATION STRUCTURE OF PAZARDJIK WATER SUPPLY AND SEWERAGE COMPANY

Proposed Organizational Improvements to Facilitate Operation of the New WWTP at Dimitrovgrad (Part Diagram – Refer to Existing)

(1) Operation Division Structure



(2) Indicative WWTP Operation

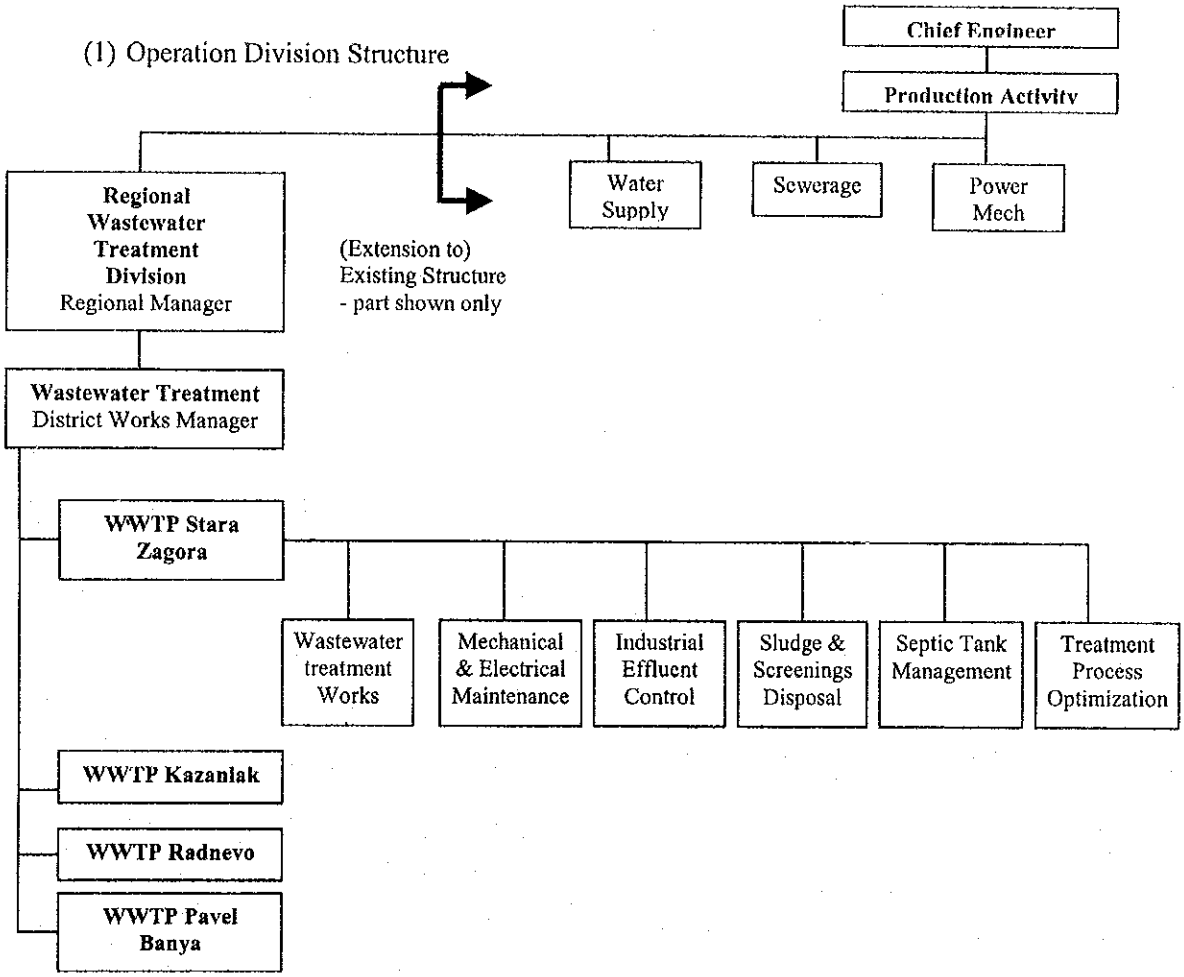


Note: * It is noted that in Bulgaria, operators are often normally M&E trained personnel. The term "operator" above, is therefore a generic term and includes different levels of operator.

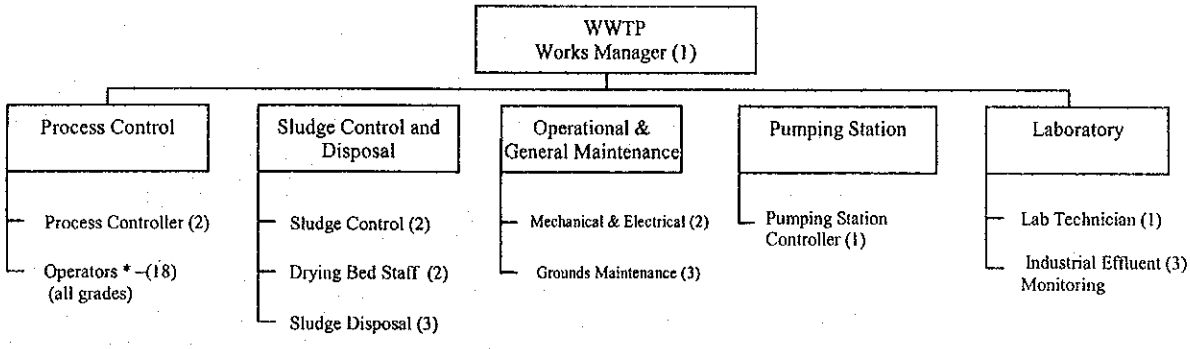
FIG.I.3.2 PROPOSED ORGANIZATION STRUCTURE OF DIMITROVGRAD WATER SUPPLY AND SEWERAGE COMPANY

Proposed Organizational Improvements to Facilitate
Operation of the New WWTP at Stara Zagora
(Part Diagram – Refer to Existing)

(1) Operation Division Structure



(2) Indicative WWTP Operation



Note: * It is noted that in Bulgaria, operators are often normally M&E trained personnel. The term "operator" above, is therefore a generic term and includes different levels of operator.

FIG.I.3.3 PROPOSED ORGANIZATION STRUCTURE OF STARA ZAGORA WATER SUPPLY AND SEWERAGE COMPANY

SUPPORTING REPORT J
SOCIO-ECONOMY AND FINANCIAL ANALYSIS

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SUPPORTING REPORT J SOCIO-ECONOMY AND FINANCIAL ANALYSIS

1. Present Socio-Economic Conditions

1.1 Administration Boundary and Population

Fig. J.1.1 shows the administration boundary in the study area. The study area is divided into 3 regions of Plovdiv, Haskovo and Burgas Regions composed of 54 municipalities. Table J.1.1 shows population in the study area for each region and municipalities. Total population in 1992 census for the study area was 1,747,334 persons, which is composed of 1,177,038 persons (67 %) in urban areas and 570,296 persons (33 %) in rural areas as shown in Table J.1.2. Table J.1.3 shows the basin-wise population in the study area.

1.2 National Socio-Economic Performance and Projections

Gross Domestic Product

To compare the economic performance of Bulgaria in different years, a deflator is derived from available statistics. Applying the deflator, it is shown that the Bulgarian economy had grown in real terms continuously from 1980 through 1988. The growth varied among broad economic sectors. The average annual growth during this period was 1.4% for agriculture, 6.0% for industry, and 2.5% for services. The gross domestic product (GDP) had grown at 4.3% per annum during 1980-88.

Since 1989, the GDP decreased in real terms consistently to reach the lowest level in 1993 (Table J.1.4). The GDP in 1993 was only 62% of the maximum attained in 1988. The GDP recovered slightly in 1994. During this latter period, the industrial GDP decreased consistently. The agricultural GDP also declined generally up to 1993, except a short boom in 1990. It started to recover since 1993. The services sector, after a small setback during 1990-92, has been generally expanding. As a result, the economic structure of Bulgaria has

changed as shown below.

Changes in Economic Structure of Bulgaria

(Unit: %)

	1980	1985	1990	1995
Agriculture	14.4	11.9	17.7	14.1
Industry	53.8	62.5	51.3	34.7
Services	31.8	25.6	31.0	51.1

1.3 Value-Added Per Employee

Value-added per employee in different sectors is calculated from the GDP and the employment data in Tables J.1.5 for the period 1989-95. Results are shown below.

Changes in Value-Added per Employee by Economic Sectors

(Unit: thousand leva in 1995 prices)

	1989	1990	1991	1992	1993	1994	1995
Agriculture	176.0	260.8	194.7	141.9	116.4	130.4	140.9
Industry	382.7	306.2	280.3	254.8	223.9	219.1	243.0
Services	255.9	233.8	238.5	303.2	328.3	328.0	286.5
Total	300.0	271.7	247.7	249.8	241.9	243.0	237.1

The value-added per employee in agriculture attained the maximum level in the boom year of 1990, but decreased rapidly since then. This labor productivity, as crudely called here, reached a minimum in 1993 when it was only 45% of the productivity attained in 1990. The value-added per employee in industry declined consistently to reach the level in 1994 lower than 60% of the productivity in 1989. The services sector is the only sector where the productivity started to increase already in 1991, although it has declined slightly in the latest years.

Contribution of the private sector in GDP and employment is summarized in Tables J.1.6 and J.1.7, respectively. Value-added per employee in the private sector is calculated by economic sector for the period 1993-95, for which consistent data are available.

Value-Added per Employee in the Private Sector

(Unit: thousand leva in 1995 prices)

	1993	1994	1995
Agriculture	128.6	140.4	140.4
Industry	303.3	259.1	305.6
Services	655.6	542.1	512.7
Total	323.5	290.0	292.3

Comparison between the two tables above reveals the following. The value-added per employee is larger in the private sector in 1993 for all the economic sectors. The performance of the private sector thereafter has been unstable, but the productivity is generally higher in the private sector. The divergence of productivity between the public and the private sectors is the largest in the services sector, which has undergone the privatization from the earliest time. The productivity in agriculture is mixed outcome of the privatization and the land restitution. The privatization in industry was the slowest and the least attained during this period (Table J.1.6)

1.4 Socio–Economy of Maritza River Basin

(1) Basin Sub–Division for Socio–Economic Analysis

Maritza river basin is sub–divided into the five sub–regions for socio-economic analysis in the study: Upstream, Mid-central, Mid–lower, Sazliyka, and Downstream sub–regions (Fig. J.1.2).

Upstream sub–region consists of four major tributaries, viz. Topolnitza, Chepinska, Luda Yana and Stara rivers, as well as the Maritza main stream. Mid-central sub–region contains four major tributaries, viz. Pyassachnik, Vacha, Chepelarska and Stryama rivers. Mid–lower sub–region is composed of many smaller tributary basins. Sazliyka sub–region corresponds to the Sazliyka river basin. Downstream sub–region has the Harmanliyska river basin and several small tributaries. Socio-economic characteristics of the Study Area are summarized in Table J.1.7 to Table J.1.9.

(2) Existing Socio–Economic Conditions

1) Population and urbanization

The total population of the Maritza river basin decreased from 1.93 million in 1989 to 1.75 million in 1995, which accounts for 21% of the national population or 8.41 million in 1995. Urbanization ratio in the basin is about the same (67.4% in 1995) as the national average (67.7% in 1994), but the basin contains the most populated area in the Country outside the capital region. Mid-central sub-region has the largest urban population of the entire sub–regions in the basin, and Plovdiv, the largest urban center in the basin, has the highest density of all the urban centers in the Country. Both total and urban population decreased slightly between 1985 and 1995. Of 24 major urban centers in the Country having population over 500,000 only seven gained urban population during 1985-95. Assenovgrad in Mid-central sub–region recorded the highest growth of urban population, 2.6% over 1985–95.

2) Land cover

A map showing the existing land cover in the Study Area has been produced, extracted from the CORINE database. Of the 32 land use categories identified in the map, nine correspond to agricultural land use covering in total 10.2 thousand km^2 (48% of the basin), including agro-forestry as well but not grassland and pasture, and three correspond to forest land covering 7.0 thousand km^2 (33%) consisting of broad-leaved, coniferous and mixed forests, but not transitional woodland/shrub not agro-forestry. Forest coverage varies among the sub-regions, ranging from 48.9% in Upstream sub-region to 13.2% in Sazliyka sub-region. Agricultural land varies between 68.2% in Mid-lower sub region and 32.7% in Upstream sub-region. Settlements and urbanized area occupy only 4.6% of the basin.

3) Agriculture

Wheat is by far the most important crop in the entire sub–regions. Upstream and Mid-central sub–regions, coinciding largely with Plovdiv district, are exclusive producers of rice in the country. These sub–regions have comparative advantages in various vegetables, apple, plum and potatoes production as indicated by higher yields than respective national averages.

Grapes are produced widely in Mid-central, Mid–lower, Sazliyka and Downstream sub–regions, especially on skirts of mountains and hill slopes. Other important industrial crops are tobaccos produced mainly in Mid-central, Sazliyka and Downstream sub–regions, sunflower in Sazliyka sub–region, and cotton in Downstream sub–region. Distribution of cereals production depends on altitude and soil conditions. Wheat is more dominant in Upstream, Mid-central and Mid–lower sub–regions, rye is produced mainly in Mid-central sub–region, and barley is more widespread in Mid–lower and Sazliyka sub–regions.

The Maritza river basin is also an important livestock-producing region. There exist a few big farms for pigs in the basin, but much larger livestock and poultry population is raised by individual farmers.

4) Industry

The Maritza river basin has both indigenous resources–based industries and some of those strategic industries allocated to the country under the division of work system during the COMECON regime. Most important resources-based industries in the basin are coal mining and metallurgy. Coal production in Radnevo, Galabovo and Dimitrovgrad contributes some 75% to the national production value. Non–ferrous metallurgy in Upstream and Mid-central sub–regions contribute significantly (about 30%) to the national production. Other resources–based industries are pulp and paper,

and wood products in Upstream and Mid-central sub–regions, textile in Downstream sub–region, and tobacco mainly in Sazliyka and Downstream sub– regions as well as food processing.

Machinery and chemicals represent the strategic industries in the basin. These industries as well as building materials and food processing industries are widespread in the basin. The basin is also a significant producer of electricity with both thermal power plants based on local coal production and hydro power plants, contributing some 30% to the national production.

5) Social indices

Only limited data on social indices have been obtained. Birth and death rates may reflect not only health but also broader social conditions of people, which may in turn due to their economic status. Both birth and death rates are slightly better in the Study Area than the respective national averages.

Death rates vary more widely among the sub-regions between 9.7 per 1,000 in the Mid-central sub-region and 16.0 pre 1,000 in the Mid-lower sub-region. Infant mortality rate in the Study Area is higher than the national average. Within the Study Area, the rate is again the highest in the Mid-lower sub-region and the lowest in the Mid-central sub-region.

2. Socio-Economic Framework

A macro framework for the socio-economic development of the Maritza river basin has been worked out for the year 2015. The macro framework specified the projected socio-economy in the basin by using the gross regional domestic product (GRDP) and employment by agriculture, industry and services, and the population in urban and rural areas.

According to the macro framework, the GRDP of the Maritza river basin will grow at 6.8% per annum on an average through 2015, supported by the annual average growth of agriculture at 3.0%, industry at 7.5% and services at 7.0%. The total population in the basin will become 1,921,000 in 2015, representing a 10% increase from the population in 1995. The rural population will decrease slightly, and the urbanization ratio will increase to 71% in 2015.

The projection of the GRDP and employment in the Maritza river basin is summarized below:

	GRDP (million Leva in'95 price)		Average annual growth (%)	Employment	
	1995	**2015**	**1995-2015**	**1995**	**2015**
Agriculture	20,000	36,000	3.0	147,000	90,000
Industry	62,000	263,000	7.5	255,000	376,000
Services	72,000	279,000	7.0	244,000	349,000
Total	154,000	578,000	6.8	646,000	815,000

Such socio-economic development as specified above will be supported by various economic activities. Prospects of various agricultural and industrial activities are examined in the following and the agricultural and industrial value-added projected by sub-sector to justify the projected socio-economy in 2015.

2.1 Agricultural Value-Added

(1) Introduction

Agricultural land occupies 48.3% of the Maritza river basin, consisting of areas under fruit trees and vineyards, irrigated areas and non-irrigated areas. Most of the agricultural land is arable and suited to various crops depending on irrigation, fertilizer application and other farm management practices. As the land restitution proceeds, farmers will re-establish the cropping patterns that were found successful before 1989 with some changes reflecting new marketing opportunities. Agricultural land use in the basin may change further in the future, but the basic land use patterns established over decades will remain largely the same. The main direction for agricultural development in the basin is to increase value-added for existing crops by adopting better farm management with limited crop conversion.

The agricultural value-added is estimated by crop for 1995 and projected to 2015. First, production value and costs are determined for various crops both under prevailing conditions and under improved conditions expected in the future. Unit value-added is determined by crop in both cases. Second, cropping patterns are associated with the existing agricultural land use, and the present agricultural value-added is re-established. Finally, an attempt is made to project the agricultural value-added to the year 2015 by assuming improved farm management for each of agricultural land use categories.

(2) Indicative Crop Budget

Expenditure of crop production was analyzed by another JICA study for three areas in Bulgaria (JICA, Feasibility Study on the Project for Agricultural Reform in Bulgaria). One of the areas covers a small area in Nova Zagora within the Maritza river basin, where many crops found widely in the basin are cultivated. Improved farm management practices are recommended by this earlier study for cereals, maize and other fodder crops, and various

horticultural crops. Expenditure of crop production with and without the improved farm management is adopted from the study as summarized in Table J.2.1.

To determine production value for various crops, yields and prices are assumed. Present yields are assumed based on agricultural statistics for districts of the Maritza river basin. Yields under the improved farm management are assumed to be 20% higher than the respective present yields for different crops. For international market prices at the farmgate, price data reported in the earlier study are adopted. Unit value-added per ha with and without the improved farm management is calculated for each crop. Results are given of in Table J.2.2.

(3) Present Conditions

Agricultural land use

Agricultural land use in the basin is defined by nine land use categories of the CORINE land use map. This comprises non-irrigated agricultural land consisting of annual crops associated with permanent crops, complex cultivation patterns, non-irrigated arable land, and land principally occupied by agriculture with significant areas of natural vegetation, irrigated land consisting of permanently irrigated land and rice fields, and other agricultural lands consisting of fruit trees and berry plantations, vineyards and agro-forestry areas. The agricultural land occupies 1,029,600 ha in total, consisting 734,500 ha non-irrigated land, 221,600 ha irrigated land, and 73,500 ha of others.

Agricultural value-added

Unit value-added per ha is determined for each of the agricultural land use categories. Each agricultural land use category contains a certain mixture of different crops, except paddy fields and vineyards. Unit value-added of each category is determined based on unit value-added of dominant crops. Assumptions on dominant crops and calculation results are

summarized in Table J.2.3.

As seen from Table J.2.3, the total crop value-added is calculated to be Lev. 11,900 million in 1995, while the total agricultural value-added is estimated above at Lev. 20,000 million in 1995. The balance Lev. 8,100 million or 40.5% of the agricultural value-added is attributable to livestock and other minor activities.

(4) Projection of Agricultural Value-Added

Broadly within the same agricultural land use patterns, agricultural productivity in each land use category will increase in the future. Larger areas will be devoted to crops of higher value-added, and yields will increase through the improved farm management. Only in the category of agriculture with significant natural vegetation, horizontal expansion of agricultural land will take place using part of the land under natural vegetation. Unit value-added of each land use category is determined based on unit value-added of dominant crops with the improved farm management given in Table J.2.3. Pastures will be partly upgraded into managed pastures to support the boosting of the livestock sub-sector.

The agricultural value-added is projected to the year 2015 under these assumptions. The projection and the assumptions are summarized in Table J.2.4. As shown in the table, the total crop value-added is projected to increase to Lev. 19,600 million in 2015, representing an annual average increase of 2.53%. To attain the total agricultural value-added of Lev. 36,000 million in 2015 according to the macro framework, livestock and other sub-sectors will have to grow at 3.59% per annum to reach Lev. 16,400 million by 2015. The share of these latter sub-sectors will increase to 45.6% of the agricultural value-added.

2.2 Industrial Value-Added

(1) Introduction

The industrial value-added in the Maritza river basin has been estimated by sub-sector for 1995. It is projected here to the year 2015. As Bulgaria has been undergoing major economic turmoils and industrial production declined drastically in early 1990's due to losses of both domestic and export markets, production and export performance in recent years is examined at the national level, first. Prospects of different sub-sector industries are indicated.

Second, industrial development in the Maritza river basin is assessed by sub-sector with respect to raw materials availability and existing facilities as well as markets. Combined with the national level examination, prospects of industrial development in the basin are indicated by sub-sector. Finally, an attempt is made to project the industrial value-added by sub-sector based on assumed growth rates determined in accordance with the assessment.

(2) National Industrial Production and Export Performance

Production and export value by sub-sector of the Bulgarian economy for four recent years from 1989 to 1995 has been expressed in 1995 prices and is summarized in Table J.2.5. Referring also to national statistics on production and export quantities of different industrial products, past performance and future prospect of each sub-sector industry have been assessed as summarized in Table J.2.6.

Output of all the sub-sector industries declined drastically in early 1990's. This is due primarily to losses of domestic and export markets. In general, those sub-sectors depending more on the export market decreased their output more significantly. Thereafter, the export started to recover steadily for some sub-sectors and more slowly for some others, but a few sub-sectors have not shown a clear sign of recovery.

In the meantime, export and import structure by country has changed significantly as shown in Table J.2.7. The dominant shares of the former USSR decreased significantly in both export and import value. The decreases have been compensated largely by increased

shares by Western European countries.

On the whole, export value is recovering more rapidly. While the production value in 1995 is only 32% of that in 1989, the export value in 1995 is already 75% of what was attained in 1989. The increase in export value is due to both increased prices in international markets and recovery of export quantities of limited price competitive goods directed to new and old markets.

(3) Sub-Sector Performance and Prospect

Coal is produced in Bulgaria almost exclusively for the domestic market. This is the only sub-sector that did not decrease its production during the early 1990's. The production value, however, declined due to decreases in prices in real terms. Production in this sub-sector will increase only in response to domestic demand as the economy recovers. The oil and gas sector is insignificant in Bulgaria.

The ferrous metallurgy sub-sector has increased its dependence on the export market, as the production value declined but the export value increased over 1989-95. Production quantities are recovering fast for most products. Pig iron and ferro-alloys had recovered by 1995, their production in 1989, and steel production attained in 1995, 94% of production in 1989. This sub-sector will continue to grow as it has comparative advantage for export, if facilities are continually rehabilitated and upgraded.

The non-ferrous metallurgy sub-sector in Bulgaria produces mostly for the domestic market. The production declined sharply at the beginning of 1990's, but the production value recovered by 1995 to 87% of what was attained in 1989, supported by increased prices. Production quantities will continue to increase steadily as the economy recovers.

The machinery and metal works sub-sector decreased its production most drastically, and the production value in 1995 is only 19% of that in 1989, the second lowest next only to

the electrical and electronics sub-sector. Most products have not shown any sign of recovery as of 1995. The export value, however, shows a sign of recovery, supported by limited products such as tools, implements and other small metal products and some mechanical appliances. Both export and domestic markets for this sub-sector may recover but only slowly.

Both production and export of the electrical and electronics sub-sector declined drastically. No sign of recovery is seen, while the import value of this sub-sector is increasing. The production and the export value in 1995 was only 11% of the respective value in 1989. Production performance varies distinctly among different commodities. Therefore, product specialization may be a direction to pursue for more promising products such as electric generators, tools and boilers.

The production value of the chemical and oil products sub-sector started to recover by 1995, while the export value has been largely on the increase. Production quantities are recovering fast for most products. Some products in this sub-sector have strong export performance with established markets such as some essential and other industrial oils and various nitrogen products. Their exports are constrained only by production. This sub-sector will recover fully and expand further.

Sub-sectors of building materials, pulp and paper, wood products, and china and glass products reduced their respective production value, but they show a sign of recovery, except the wood products sub-sector. Export has small shares in respective production, but the export value of these sub-sectors increased significantly. As the domestic demand increases, the export of these sub-sectors will taper off. Import will increase as well.

Sub-sectors of textile, apparel, and leather and footwear are consistently decreasing their respective production value. The production value in 1995 was 29% of that in 1989 for textile, 21% for apparel, and 31% for leather and footwear. In the meantime, the export value of these sub-sectors increased slightly. These increases are supported in part by

export processing of those manufactures working on orders from foreign firms and with materials supplied by them as reflected also in increased import. These sub-sectors will grow based on expansion of domestic market and export processing as well as increase in domestic supply of raw materials such as cotton and raw leather.

The food, beverages and tobacco sub-sector is reducing its production value, but its export value is steady due to established markets with reputation for some products. Production quantities in 1989 were fully recovered by 1995 for vegetable oils, grape wines and some other products. These products also have strong export performance. Tobacco products also recovered fast to attain by 1995, 87% of the production in 1989. The domestic market for this sub-sector will recover and further expand with products diversification as income levels increase, and the export market will continue to grow steadily with further specialization.

(4) Assessment of Industrial Development in the Maritza River Basin

Prospects of different sub-sector industries in the Maritza river basin depend on the overall performance of respective sub-sectors at the national level as examined above, and comparative advantages of the basin vis-à-vis other regions with respect to raw materials availability, existing facilities, related industries and services, labor force and other conditions. Broad assessment is made by sub-sector for industrial development in the Maritza river basin. Table J.2.8 summarizes major constraints faced by different sub-sectors in the basin and their prospects.

The non-ferrous metallurgy sub-sector is most promising in the Maritza river basin due to the availability of raw materials and existing facilities and technology. The sub-sector is supported by the domestic demand that will increase steadily as the economy recovers. Prerequisites for further growth are to solve existing and anticipated environmental problems and to upgrade some facilities.

The chemical and oil products sub-sector is next most promising, particularly for the export market. Further product diversification in favor of high value products will be realized with additional investments. Promising activities include cosmetics and perfumery, pharmaceuticals including herbal medicine, fertilizer and other sulphur or nitrogen based chemical compounds.

The food, beverages and tobacco sub-sector will continue to be the main thrust of industrial development in the Maritza river basin with continual product development. A key for the domestic market will be product diversification to meet changing demands as income levels increase. For the export market, further specialization will be realized for specific target countries. Examples may include preserved vegetables and temperate fruits as well as live animals to Middle East countries, wines and spirits to Japan, tobacco products to Russia, and fresh vegetables to European countries.

Some existing industries in the machinery and metal works sub-sector have been assessed as competitive in international markets such as polishing machine works in Assenovgrad and metal-cutting machine works in Velingrad. Others would need substantial investments to improve their operation, and some of them may be closed. The electrical and electronics sub-sector as a whole will grow only slowly as limited products will be viable in the domestic and the export markets.

Other indigenous resources based industries have good prospects in the medium to long term, although their growth rates will not be among the highest due to inherent characteristics of this type of industries. The building materials sub-sector seems viable supported by good quality raw materials as indicated by high export performance even during the depressed economic situation. The wood products sub-sector will attain higher growth as more raw materials currently exported are processed domestically into high value products. The pulp and paper sub-sector as a whole seems viable as manifested by good export performance in recent years, but in the Maritza river basin major renovation of facilities will be required to expand production.

Sub-sectors of textile and apparel may expand in the medium term with substantial foreign investments mainly for export processing. In the short term, existing production capacities can be utilized as the domestic market recovers. Growth of the leather and footwear sub-sector will be based on expansion of raw materials base by import for export processing in the medium term, and by boosting the livestock sector in the long term.

(5) Projection of Industrial Value-Added

Prospects of different sub-sector industries assessed above are broadly reflected in the projection of industrial value-added. Sub-sectors are ranked into high, medium or low with respect to prospects in the Maritza river basin based on their growth prospects in the domestic and the export markets and the contribution of the basin to the respective national production. Even if a sub-sector has low growth prospects as a whole (nationally), the Maritza river basin may contain more viable factories and products if its contribution to the national production is large.

Growth rates of different sub-sectors are assumed depending on their prospects in the Maritza river basin and whether or not they are indigenous resource based. In general, indigenous resource based industries have lower growth rates constrained by the availability of raw materials. Results are summarized in Table J.2.9.

Using the assumed growth rates, value-added in mining and manufacturing is projected by sub-sector. Results are shown in Table J.2.10. As seen from the table, the value-added in mining and manufacturing is projected to increase from Lev. 46,100 million in1995 to Lev. 189,500 million in 2015 at an average annual rate of 7.3%. The value-added in construction and utilities are assumed to increase respectively at 7.0% and 9.2% per annum to make the total industrial value-added Lev. 263,000 million in 2015.