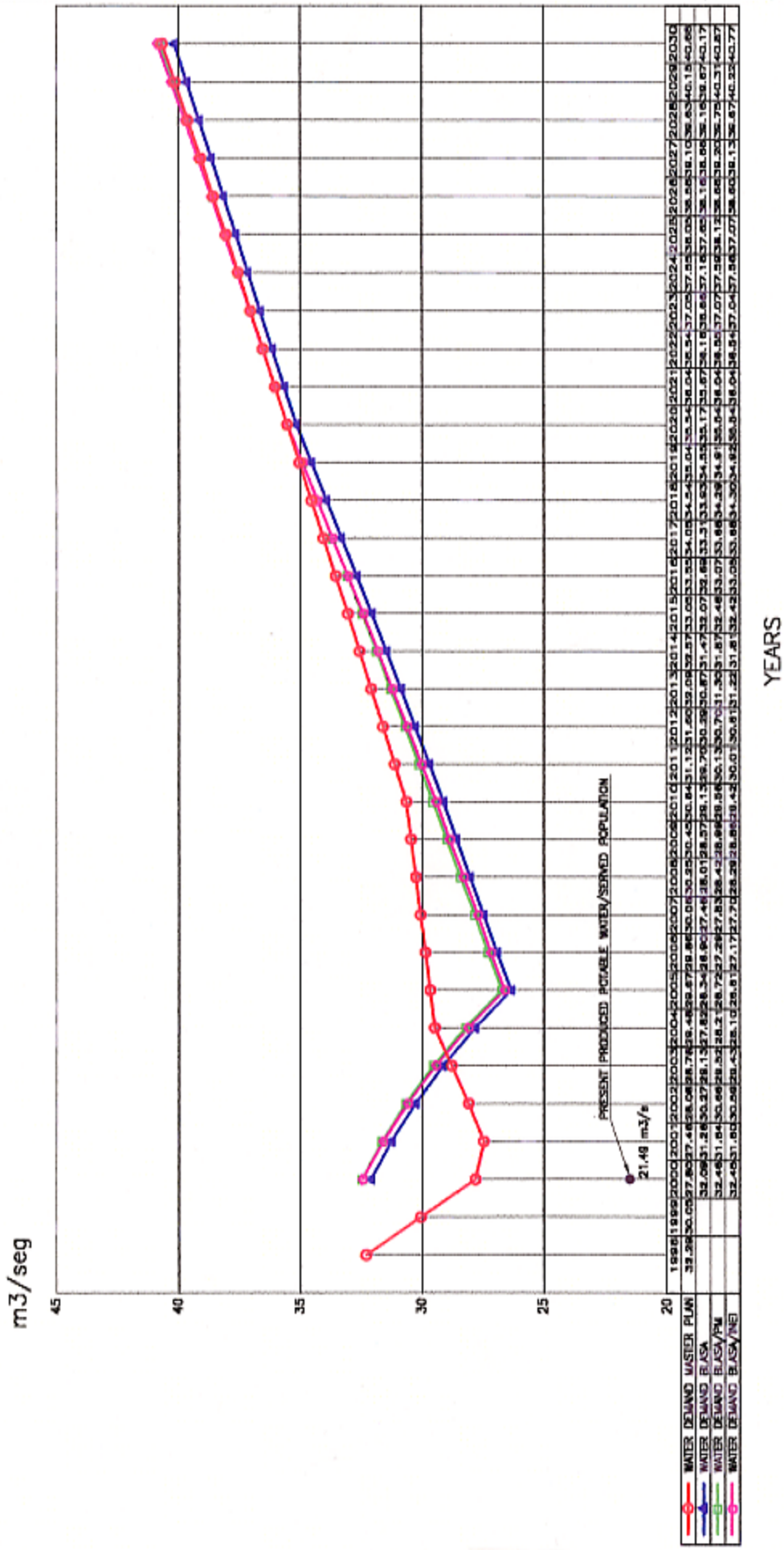

STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT
IN
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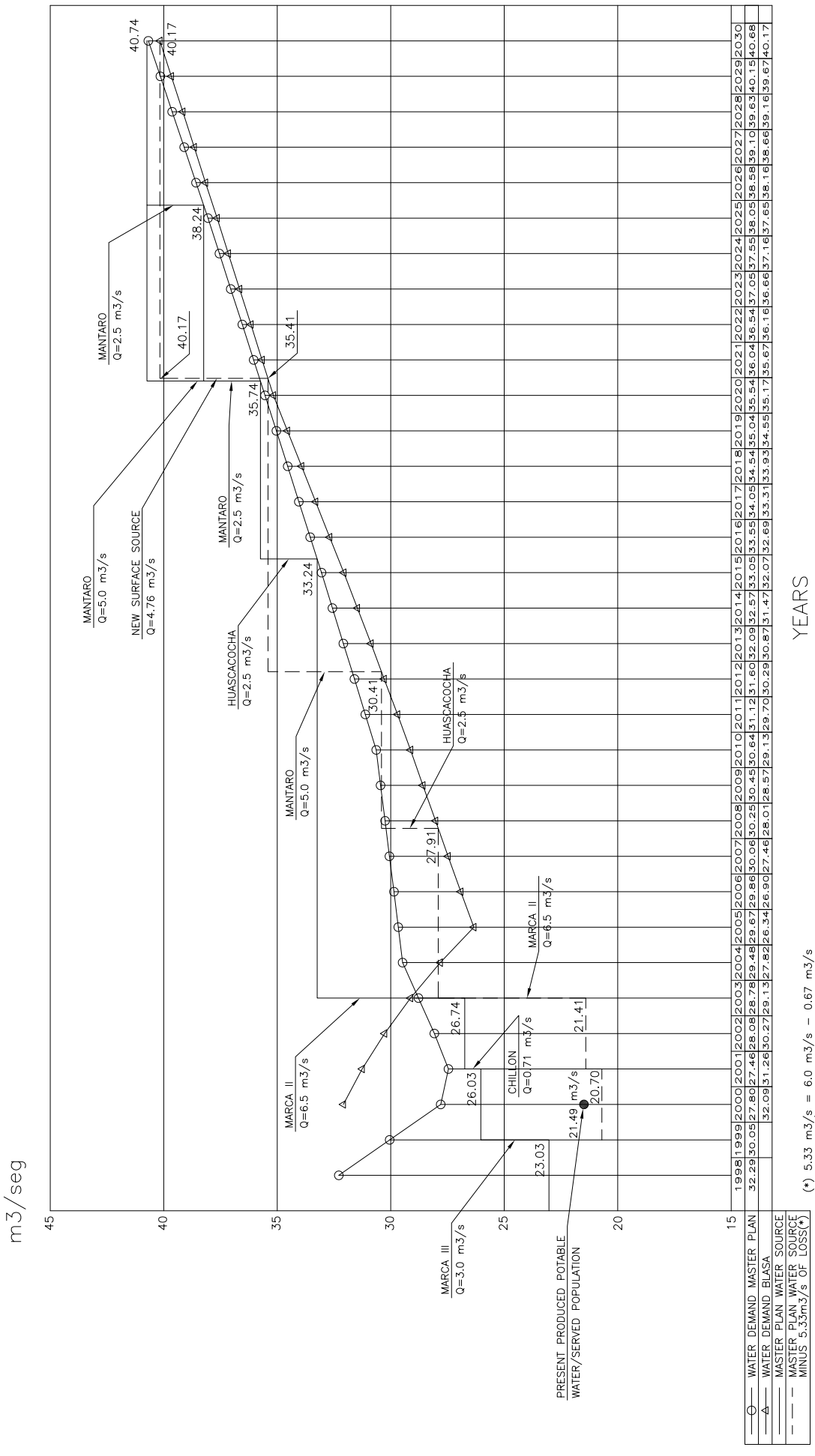
Figure 9.4.1

Average Daily Water Demand



STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU	Figure 9.4.2 Reviewed Sedapal Proposed Expansion System
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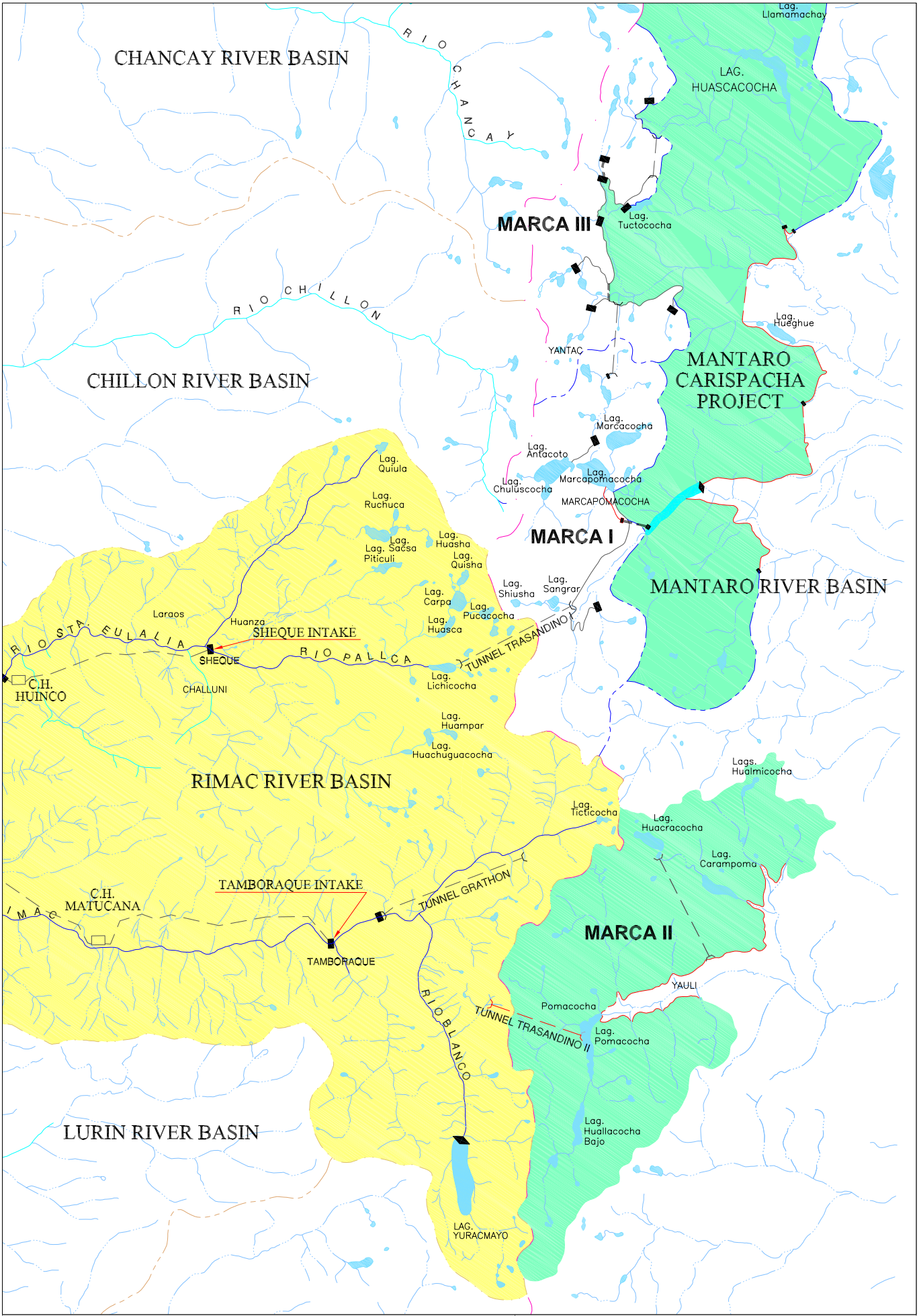
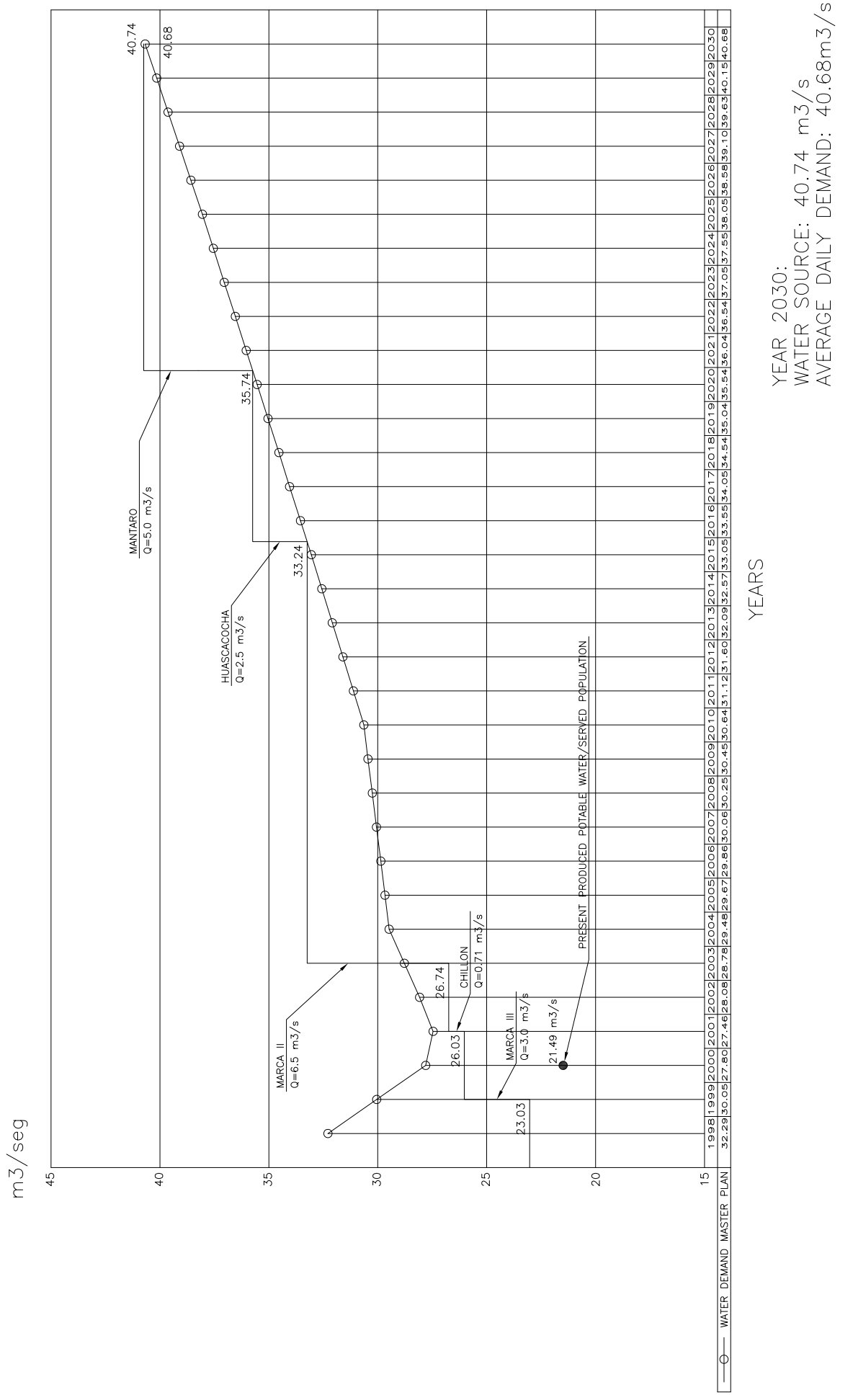


SUPPLEMENTAL INVESTIGATION OF THE STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU THE JAPAN INTERNATIONAL COOPERATION AGENCY	Figure 9.4.3 Location Map of Future Plans in Mantaro River Basin



STUDY ON INTEGRATED WATER RESOURCES DEVELOPMENT IN THE CAÑETE RIVER BASIN IN THE REPUBLIC OF PERU	Figure 9.4.4 Sedapal Water Demand And Proposed Expansion System
THE JAPAN INTERNATIONAL COOPERATION AGENCY	

CHAPTER 10 INTEGRATED MASTER PLAN AND CONCLUSIONS

Based on the results of studies in the foregoing chapters 4, 5, 7, 9 and other relevant sections, the integrated water resources development future plan of the Cañete river basin and its conclusions are hereunder presented in terms of 'Development of water resources' and 'Management of water resources'.

1) Development of water resources would be realized with the allocation of 34.2 MCM/year for D/I water supply in the Cañete basin, 351.4 MCM for 27,000 ha Concon-Topara irrigation scheme, and instream water use for 270 MW hydropower with the power plants at the El Platanal (220MW) and Morro de Arica (50MW). An implementation schedule of the development is shown in Figure 10.1. New D/I water source to the capital region of Lima would preferably be sought in the Mantaro river basin.

2) Management of water resources would be currently more acute in the Rimac river basin compared with the Cañete basin. Requirement of the water resources management for the Cañete basin would be hi-lighted when the issue on water allocation and water contamination becomes an indicator that may be accompanied with the progress of the water resources development. Further details are described in the following sections.

10.1 Development of Water Resources

(1) D/I water supply

The D/I water supply to the area inside the Cañete basin requires high priority, though its amount is relatively small. Supply to Concón-Topará is indispensable if a large scale irrigation development therein is to be implemented. Supply to the coastal area is also ranked at medium priority since the area is outside of the basin. D/I water to the Cañete basin and Concon-Topara will amount to 34.2 MCM/year.

Legal priority of water supply to the region of Lima city is relatively low, since the command area is outside the Cañete river basin. Lima is however the capital city of Peru with population of over 7 million, or about 30% of the country, therefore, high priority should be placed on D/I water supply from national policy view point. Alternatives of new water source to Lima are water in the Cañete river basin and water in the Mantaro river basin. Although the water conveyance from the Cañete river basin indicated to be a feasible option, transfer from the Mantaro river basin

would be preferred option, since the economic viability lies superiority on it (e.g. Mantaro - Carispaccha plan) and probable serious objection by the people in the Cañete river basin against the transfer of water to other basin, as referred to Sections 4.3.2 and 5.2.

(2) Hydroelectric power

Hydroelectric power is ranked at medium status on legal and policy priority of water resources development. Development of El Platanal and Morro de Arica hydroelectric power plants with construction of dams at Morro de Arica are in-stream system with marginal consumption of water, which will have relatively high economic viability, as referred to Sections 4.3.4 and 5.2.

(3) Irrigation

It is considered useful and important to rehabilitate and improve the existing agricultural land on the right bank downstream of the Cañete River, so called Cañete Valley with an area of about 24,000 ha. An official financing aid has already been made by OECF (now JBIC) of Japan and World Bank for a part of such agricultural areas in Peru in 1996, and allocation of budget was made in April 1999 for the implementation of rehabilitation and improvement of the intakes and canals in the Cañete Valley, as referred to Section 4.3.3. Pampas Atlas de Imperial is located relatively high land which may be economically viable if irrigation water can be provided via the D/I water conveyance canal to Lima. Development of Concón-Topará is coupled with the development of El Platanal and Morro de Arica hydroelectric power. It has relatively low legal priority, but will contribute to social benefit including creation of local employment, and then to decentralization, in addition to agricultural benefit.

(4) Dam

Construction of the Morro de Arica dam will be able to contribute to multiple purposes, development of hydroelectric power, irrigation and partly to D/I water supply. Topography and geology at Morro de Arica allows higher storage efficiency, or lower storage cost compared with other candidate dam sites, as referred to Section 5.1.

(5) Cañete groundwater

Aquifers in the Cañete basin is deemed to reserve countable groundwater potential as an important future water supply source, as referred to Section 2.4. The groundwater however is not accounted for the water balance analysis as a water source, since the accuracy of the potential estimate remained relatively low level due to insufficient quantitative data.

10.2 Management of Water Resources

(1) Water use

With the progress of development of water resources in the Cañete River basin, importance of providing structural and non-structural measures for its management will be hi-lighted. Strengthening of the existing gauging system will be required as one of the non-structural measures to obtain more accurate and precise data and information on climate and river runoff. Strengthening of the non-structural measures will also require an institutional provision of unified basin management organization such as AACH or others as explained in Section 8.2, with an arrangement of concrete guidelines adaptable to the nature of the basin water characteristic and use.

(2) Watershed protection

Steep sloped thick alluvial deposits remain along the mid- upstream reaches in the Cañete River basin, which yield debris flush flows sometimes in rainy season, currently damaged houses and buildings in residential areas and public works. Debris flows will also degrade runoff regulation function of planned storage, as explained in Section 7.2. Strengthening of the watershed protection will be required with provision of structural and non-structural measures to implement remedial works for controlling erosion and sedimentation managed under a unified organization mentioned above.

(3) Environment conservation

It is reported that high level of heavy metals have been discharged from the mining industries in the upstream basin, as explained in Section 6.1. Runoff observed in the river channel is reduced to almost null in the dry seasons at the estuary of the main river where the existing Cañete Valley agricultural land is located. The resort area in and around Lunahuana offers tourism with rubber boat rafting in the

main stream during wet months. Environmental conservation is one of the keen concern for sustainable development of the basin, for which strengthening of non-structural measures managed under the same unified organization will be required to maintain water quality and recreation.

(4) Flood protection

The most important districts in the basin are San Vicente de Cañete with population of about 30,000 in the south and Yauyos with population of about 2,000 in the north. The Cañete town is located in the delta along the coast, however residential area is about 5 km north of the Chico River (one of branched main stream in the delta). The Yauyos town is located in the middle reach at a relatively high land. Serious flood damages are not reported in the residential areas currently, however provision of flood protection will be preferred against potential damages due to expansion of the town in the future, as explained in Section 7.2.

(5) Monitoring

Monitoring is the base for the water management, as explained in Section 7.4. It requires non-structural measures to gauge various natural and physical conditions in relation to objectives of development, use, protection and conservation of the water resources. It also requires non-structural measures to utilize the data and information for the most effective management of respective objective as well as optimized management of multipurpose water use, eventually assuring sustainable development of water resources in the basin.