

# Chapter 1

## Introduction

### 1.1 General

Water is the most essential natural resource next to air, required for sustaining life on the earth. It is required for drinking and industrial uses, for irrigation to meet the growing food and fiber needs, for power generation, navigation and recreation. The development, use and conservation of water, therefore, play a vital role in the country's development planning. The water resources in the country are, however, limited considering the future demands. The rainfall in the country is mostly confined to monsoon season and is unevenly distributed with respect to both space and time. As a result, some parts of the country are affected by frequent droughts whereas floods affect other parts. Nearly, one third of the country is drought prone. In the very near future, water will become a scarce resource due to increasing thrust of population and increasing demands for various uses. Therefore, it need not be emphasised that water should be harnessed in the most scientific and efficient manner.

The monsoon flood waters should be conserved to the maximum extent possible to meet the demands for irrigation, power generation, domestic and other uses. The water availability and requirements in the various river basins need to be assessed realistically. The reasonable basin requirements should be provided for and the surplus water, if any, should be transferred to the needy areas. The National Water Policy adopted by the Government of India in September, 1987 and subsequently revised and updated on April, 2002 emphasizes that water should be made available to water short areas by transfer from other areas including transfers from one river basin to another, based on a national perspective.

### 1.2 National Perspective Plan for Water Resources Development

The erstwhile Union Ministry of Irrigation (now Ministry of Water Resources) and the Central Water Commission in the year 1980 formulated the National Perspectives for Water Resources Development, which comprises two main components, viz. Himalayan Rivers Development and Peninsular Rivers Development. Himalayan Rivers

Development envisages construction of storage reservoirs on the main Ganga and the Brahmaputra and their principal tributaries in India and Nepal alongwith inter-linking canal systems to transfer surplus flows of the eastern tributaries of the Ganga to the West apart from linking of the main Brahmaputra with the Ganga. Peninsular Rivers Development of the National Perspectives Plan includes interlinking of major rivers flowing in the Peninsular India including the southern tributaries of Yamuna. The major parts of this components are (i) interlinking of Mahanadi-Godavari-Krishna-Pennar-Cauvery, (ii) interlinking of west flowing rivers, north of Bombay and south of Tapi, (iii) interlinking of Ken with Chambal and (iv) diversion of west flowing rivers. The interlinking of these rivers will envisage construction of storage reservoirs at potential sites and canal systems for transferring the waters from surplus to deficit basins/areas. The canals will also include tunnels and lifts, wherever necessary.

### **1.3 Godavari (Inchampalli) – Krishna (Nagarjunasagar) Link Canal Project**

The Godavari (Inchampalli) - Krishna (Nagarjunasagar) Link forms a part of the scheme of transfer of surplus waters of Mahanadi and Godavari rivers to the deficit basins of Krishna, Pennar, Cauvery and Vaigai. The link scheme is an important part of various proposals under the Peninsular Rivers Development Component of National Perspective Plan.

This link canal proposes to irrigate the command areas proposed under Kakatiya canal Stage – II of Sri Ram Sagar Project, and Srisaillam left bank canal. A major portion of the surplus quantity diverted is to be discharged into Nagarjunasagar reservoir for further diversion to water short Pennar and Cauvery basins etc. after meeting the entire deficit of Krishna basin as envisaged in the Peninsular Rivers Development Component of the National Perspective plan.

The Godavari (Inchampalli) – Krishna (Nagarjunasagar) link canal project comprises of the following components.

- (i) A storage reservoir on river Godavari at Inchampalli with F.R.L. 112.77 m, gross storage capacity of 10374 Mm<sup>3</sup>, live storage capacity of 4285 Mm<sup>3</sup> and minimum draw down level of 106.98 m.
- (ii) A link canal of length 299.256 km (including a tunnel of 9.150 km length) off-taking from the foreshore of the Inchampalli reservoir

and out-falling into the existing Nagarjunasagar reservoir via Musi reservoir. The link will cross the main ridge between the Godavari and the Krishna basins through a tunnel of 9.150 km length. The proposal envisages the construction of a storage dam at Inchampalli on river Godavari and the two other intermediate reservoirs viz. Peddavagu & Tummalagutta. The link canal runs in moderate lifts and by gravity in its initial stages upto RD 60.500 km. The total lift involved is about 107 m in four stages: at RDs 0.000, 18.000, 26.500 and 60.500 kms are 35, 38, 23 and 11 m respectively.

- iii) The link canal further off-takes from the Musi reservoir with FSL of 187.300 m. The head available at Musi reservoir is about 9.70 m which is adequate for generation of power in the form of mini hydel scheme (canal power house). Hence, a canal powerhouse has been proposed at the canal off-take from Musi reservoir for generation of power by utilising the head of about 9.700 m, available between the reservoir FRL and the canal FSL. The water to be drawn from the Musi reservoir for onward transmission to the link canal will be guided through this powerhouse to generate power. It is proposed to install 15 units of 5 MW bulb turbines with one standby unit. The effective installed capacity of the powerhouse will be 70 MW. An approach channel of 3 km long from the reservoir to the powerhouse is proposed to suit the topography at the Musi head works. The water after power generation will be released to the main canal through a tailrace channel.
- iv) A quantum of 16426 Mm<sup>3</sup> of water is planned for diversion through this canal. Out of this, 1664 Mm<sup>3</sup> (1427 + 104 + 133) is to be used for irrigation, domestic and industrial uses in the command area enroute and 562 Mm<sup>3</sup> will be lost in transmission and the balance 14200 Mm<sup>3</sup> will reach river Krishna at the existing Nagarjunasagar reservoir.

The water received at the tail end of the link canal will be stored in the existing Nagarjunasagar reservoir on the Krishna river. The gross and live storage capacities of the reservoir at F.R.L. 179.83 m are 11560 Mm<sup>3</sup> and 5733 Mm<sup>3</sup> respectively. The dead storage level is 149.050 m.

Part of water so diverted to Nagarjunasagar reservoir will be used in meeting the entire deficit in Krishna basin by meeting the requirement of Nagarjunasagar Project (NSRBC & NSLBC). Balance water is proposed to be further diverted to Pennar, Cauvery and Vaigai river basins through a network of link canals. The link canal is proposed to be lined throughout its length.

- (v) This link will provide irrigation to the command areas under Kakatiya canal Stage – II of Sri Ram Sagar Project and Srisaillam left bank canal under Nagarjunasagar project in the districts of Khammam, Warangal and Nalgonda. A lead canal is proposed to transfer water from Inchampalli – Nagarjunasagar link canal to Kakatiya canal Stage – II. The lead canal takes-off from the link canal at RD 97.500 km after traversing a distance of 21.85 km it outfalls into the Kakatiya canal (Stage – I) at RD 260.700 km.

It was agreed by the three states (Maharashtra, undivided Madhya Pradesh and Andhra Pradesh) to construct Inchampalli dam with F.R.L 112.770 m with gross storage capacity of 10374 Mm<sup>3</sup>. The Inchampalli reservoir as proposed by Govt. of Andhra Pradesh according to the agreement with the other two states has been considered for the studies of this link canal by N.W.D.A., together with the existing Nagarjunasagar reservoir on river Krishna. The F.R.L. and gross storage capacity of the existing Nagarjunasagar reservoir on river Krishna are 179.832 m and 11560 Mm<sup>3</sup> respectively.

Detailed studies of the alignment of the proposed Godavari (Inchampalli) – Krishna (Nagarjunasagar) link canal project have been carried out on toposheets of scale 1: 50,000 and field surveys like topographical and other special surveys have been completed. Based on these studies, the feasibility of the proposal has been assessed.

## **1.4 Description of the Project**

### **1.4.1 Location**

#### **1.4.1.1 Inchampalli Project**

As per the National Perspective Plan, a reservoir at Inchampalli on the river Godavari is to be constructed with F.R.L. 118.670 m and gross storage capacity of 15640 Mm<sup>3</sup>. The Government of Andhra Pradesh has proposed to construct a reservoir at Inchampalli with reduced storage capacity, as a joint project between the States of Andhra Pradesh, Maharashtra and undivided Madhya Pradesh as per the inter-state

agreement. It is a multipurpose project envisaging irrigation benefits for the upland areas, generation of Hydel power, navigation facilities in the river, development of pisciculture and providing recreation benefits besides mitigating the flood hazards. The power benefits will be shared by all the three states. The entire surplus available upto Inchampalli dam site is proposed to be transferred to Krishna for meeting deficit in Krishna basin and for further transfer to Pennar, Cauvery, and Vaigai through Various link canals. As such power generation at Inchampalli would be limited to peaking demand for which reversible turbines and a pondage downstream of Inchampalli have been planned in this proposal. The Government of Andhra Pradesh conducted field investigations and prepared a Detailed Project Report (DPR) for the Inchampalli joint project in June, 1988. In view of the link proposal, some modifications may be necessary in the DPR. The exact nature of changes will be known at the time of preparation of Detailed Project Report of this link. A brief description of the Head works of the project is as follows.

The dam is proposed at about 12 km downstream of the confluence of Indravati with Godavari River. The river Godavari forms the boundary between the States of Madhya Pradesh (present Chhattisgarh) and Andhra Pradesh at the dam site. The right flank is located in Mahadevpur taluk of the Karimnagar district of Andhra Pradesh and the left flank is located in Madhya Pradesh (present Chhattisgarh). While carrying out the simulation studies in respect of Godavari (Inchampalli) – Krishna (Nagarjunasagar) link project the proposed Bhopalpatnam hydro-electric project reservoir and Inchampalli reservoir are considered.

#### **1.4.1.2 Godavari (Inchampalli) – Krishna (Nagarjunasagar) Link Canal**

The Godavari (Inchampalli) – Krishna (Nagarjunasagar) link canal takes-off from the foreshore of the proposed Inchampalli reservoir. The canal runs in dense forests and in naxal infested areas in the head reaches upto 78 km. The remaining length of the canal runs in agricultural and patta lands. The link canal runs for most of its length in southwest direction from Inchampalli reservoir to Nagarjunasagar reservoir. It negotiates the ridge between the Godavari and the Krishna basins through a tunnel of 9.150 km length. Total length of the link canal from Inchampalli to its outfall at Nagarjunasagar is 299.256 km. The canal passes through Mahadevpur, Matharam Mandals of Karimnagar district and Bhupalpalli, Venkatapuram, Regonda, Shayampet, Duggondi, Narasmpet, Chennaraopet, Nekkonda, Kesamudram, Nellikudur,

Dhantalapalli Mandals of Warangal district and Nutankal, Jajireddigudam, Suryapet, Ketipalli, Nakrekal, Tiparthy, Nidmanoor, Anumula and Peddavoora Mandals of Nalgonda district.

### **Lead Canal**

It was planned to provide irrigation to the command areas under Kakatiya canal Stage – II of Sriram Sagar Project in the districts of Khammam, Warangal and Nalgonda through the Inchampalli – Nagarjunasagar link canal project. A lead canal is proposed to transfer water from Inchampalli – Nagarjunasagar link canal to Kakatiya canal Stage – II. The lead canal off takes from the link canal at RD 97.500 km with FSL 244.90 m. After traversing a distance of 21.85 km it outfalls into the Kakatiya canal (Stage – I) at RD 260.700 km where the FSL of lead canal is 256.527 m. It involves a total lift of around 55 m for transferring 218 Mm<sup>3</sup> water. The above lifting is proposed in two stages comprising of 40.00 m at its off-take and another 15.00 m at RD 21.00 km.

#### **1.4.1.3 Nagarjunasagar Project**

The terminal reservoir, Nagarjunasagar was constructed by the Govt. of Andhra Pradesh near the historical Nagarjuna Konda in Nalgonda district for harnessing the waters of Krishna River for irrigation and power generation. It is situated at about 100 km downstream of the Srisailem Hydro Electric Project and at a distance of about 150 km upstream of the Prakasam Barrage on the river Krishna. The dam is accessible by road from Hyderabad, Guntur and Macherla, the road distances being approximately 145 km, 150 km and 24 km respectively from the dam. Macherla is the nearest railway station located on Macherla-Guntur Metre Gauge line.

The Nagarjunasagar Right Bank Canal (NSRBC) named as "Jawahar Canal" runs for a length of 202.75 km. It serves an ayacut of 4.75 lakh ha in Guntur and Prakasam districts. It was designed as a contour canal for a head discharge of 311.50 cumec.

The Right Canal powerhouse is situated to the left (NSLBC) of the NSRBC at the toe of the right flank of the non-over flow dam. Installed capacity of the powerhouse is 3 x 30 MW. After power generation, the water flows into the NSRBC through the tailrace channel.

The Nagarjunasagar Left Bank Canal (NSLBC) is known as “Lalbahadur Canal” runs for a length of 179 km. It serves an ayacut of 4.25 lakh ha in Nalgonda and Khammam districts. It was designed for a head discharge of 311.5 cumec. The canal off takes from the Head sluice through twin tunnels 5 km long with high approach and exit cuts. A powerhouse is situated at the head of left canal with installed capacity of 2 x 30 MW. Water is drawn through the power sluices and after power generation it flows into the NSLBC through tailrace channel.

#### **1.4.2 Climatic Conditions**

The climate of Andhra Pradesh in which the link project is located, may be broadly classified as (i) Tropical rainy and (ii) Hot steppe. Geographically the state can be divided into three sub-divisions.

- (i) Coastal Andhra Pradesh - Consisting of Nellore, Guntur, Prakasam, Krishna, West Godavari, East Godavari, Vishakhapatnam, Vizianagaram and Srikakulam districts.
- (ii) Rayalaseema - Consisting of Chittoor, Cuddapah, Anantapur and Kurnool districts.
- (iii) Telangana - Consisting of Adilabad, Karimnagar, Nizamabad, Medak, Hyderabad, Rangareddy, Mahbubnagar, Nalgonda, Warangal and Khammam districts.

The climate of Telangana region, in which the Inchampalli - Nagarjunasagar link traverses is mostly Tropical rainy. The summers are hot but winters are relatively pleasant.

The climate of Khammam district is comparatively equitable and although it is very hot in May with mercury rising upto 52° C. The normal rainfall is 1124.0 mm, and 79.2 % of the total rainfall is received through Southwest Monsoon, which is fairly reliable.

The Warangal district generally tends to be dry and there is no much fluctuation in the temperature. It gets quite hot during the summer months of April, May and June and also continues to be warm in the rest of the year except during December and January when the temperature drops slightly. The maximum and minimum temperatures have been recorded as 50.5° C and 13.5° C respectively. The rainy season sets in the district with the onset of Southwest monsoon in the later part of

June, and last till end. The normal annual rainfall of the district is 1048.1 mm. The maximum rainfall occurs in the months of July, August & September and the highest rainfall occurs in Mulug, Parkal, Mehabubabad and Narsampet mandals.

The general climate of Nalgonda district is characterized by a hot summer and general dryness except during the South-West monsoon. The year may be divided into four seasons. The cold season from December to February is followed by the summer season from March to May. The period from June to September marks the Monsoon season and contributes about 71% of the annual rainfall. October and November contribute the post-monsoon season or retreating monsoon season. On an average, there are about 46 rainy days i.e. days with rainfall of 2.5 mm or more in a year in the district. From February, both the day and night temperatures increase rapidly. May is the hottest month with mean daily maximum temperature at about 40° C and with mean daily minimum temperature at about 20° C. The day temperature may occasionally go to about 45° C during May or in June, prior to the onset of the monsoon. December is the coldest month with mean daily maximum temperature at about 30° C and night temperature may drop below to 10° C.

### **1.4.3 Topography, Physiography and Geology of the Area**

The area at the Inchampalli project site is partly flat and undulating and partly covered with parallel ranges of hills. Both banks of Godavari river at the dam site are covered by thick forests. The geological formations of the area belong to Gondwanas and puranas. The upper-Gondwanas consist of Chikialas, Kota, Malaris and Lower- Gondwanas consist of Kamthis, Barakars, Talchirs.

The link is aligned as a contour canal and it crosses a number of major and minor rivers en route. It crosses several roads as it passes through fairly developed and densely populated areas. It also crosses south-central railway main line. The types of cross drainage and cross masonry works proposed along the canal alignment wherever it crosses either a drain or road are discussed in detail in Chapter on "Structure and Layout".

The state of Andhra Pradesh has been divided into three physiographic regions viz., south Deccan plateau (53.6%) covering major part of Telangana and Rayalaseema, eastern ghats (33.4%) and coastal plains



(13%). The link canal and its command area mostly fall in south deccan plateau.

Geologically, the command area falls in Cuddapahs (Warangal, Khammam & Nalgonda), Lower-gondwanas (Khammam) and peninsular Gneisses & Granite (Khammam, Warangal & Nalgonda). Major soil types encountered along the alignment and the command area are black cotton, red, red sandy, red loamy, forest and deltaic alluvium.

#### **1.4.4 Human Population**

People living in the en route command area are mostly dependent on agriculture and extending irrigation facilities to an extent of 2.873 lakh ha will not only increase agricultural production but also create continuous, steady and all-round prosperity. The scheme is intended to provide irrigation facilities to enroute areas lying in the districts of Warangal, Khammam & Nalgonda, where either the water shortage is very acute or the existing irrigation facilities are inadequate. Total work force comprises agricultural labourers, cultivators, workers of household industry, marginal workers and other miscellaneous categories.

#### **1.4.5 Natural Resources**

The Khammam district is rich in Mineral resources. Several minerals like Coal, Iron ore, Barytes, Copper, Chromite, Corundum, Graphite, Granite, Mica Kayentie, Limestone, Marble and Dolomite are found in Khammam district.

Iron-ore, Coal, Copper, Limestone form the main minerals of the Warangal district, which are economically not exploited so far except Granite stone.

The minerals that occur in Nalgonda District are Limestone, Lead, Clay and excellent building stones. The long narrow belt of Palnadu limestones occurring along the northern bank of Krishna in Wadapally area of Damarcherla and Hazurnagar mandals, contain extensive deposits of Limestone suitable for cement industry.

#### **1.4.6 Land Use and Socio-economic Aspects**

The land use pattern falling in the proposed command area in Warangal, Khammam and Nalgonda districts through which the link canal passes is

considered for the study. The gross command area is 503746 ha. Out of that, total cropped area is 322772 ha. of which 66182 ha is cultivated during both kharif and rabi seasons (double cropped areas), out of the remaining area 131506 ha is exclusively cultivated during kharif season and 122173 ha exclusively in rabi season. The above estimate of cropland includes area under various tree plantations.

More than 70% of the population in the command area is dependent on agriculture. The literacy rate is around 50%. Around 30% of the agricultural land holdings are small.

## **1.5 Choice of the Project**

The water balance studies at Inchampalli on the river Godavari below Sri Ram Sagar Project reveal that there will be surplus water of 20327 Mm<sup>3</sup> at 75% dependability available even after the full development in the basin expected to be attained by 2025AD. Further, with the continued raise in water demand for various uses in Krishna basin, there will be deficit to the tune of 1525 Mm<sup>3</sup> at 75% dependability by 2025 AD signaling the impending danger to the commands under NSLBC, NSRBC and Krishna delta. To serve these areas and to improve the otherwise grim future scenario, it is essential to explore the nearby resources and tapping of Godavari waters at Inchampalli is one such option.

The river basins located further south including Cauvery and Vaigai, are also established to be deficient in water resources. In contrast to the water resource situation in the Krishna and other southern river basins as above, the Mahanadi and the Godavari basins were found to be substantially surplus in the water resources as per the water balance studies of NWDA, even after ultimate water resources development in these basins. Hence, the only option available to meet the deficits of Krishna and other southern basins is by diverting surplus Mahanadi and Godavari waters to Krishna and from there to Pennar and further south. The Inchampalli - Nagarjunasagar link which connects Godavari to Krishna, is a vital "Link" in the overall peninsular rivers link proposals from Mahanadi to Vaigai.

## **1.6 Stages of Development of the Project**

The Inchampalli - Nagarjunasagar link canal project is an integral part of the Peninsular Rivers Development component of NPP. The Inchampalli

high dam is an important structure for the success of the entire peninsular river development component.

The time schedule for the construction of this link project will be about 10 years. The construction of head works for the Inchampalli Project is programmed to be completed in 9 years. Accordingly, the construction of head works and powerhouse of Inchampalli joint project is programmed to start in the second year so that the same would be completed by the 10<sup>th</sup> year. It is expected that the preliminary works such as pre-construction surveys & investigations would be completed in the first and second years. The designs and preparations of drawings will be finalized by the end of the third year. The land acquisition, construction of colonies, procurement of machinery and T&P will be completed by third year. The canal excavation including the excavation of 9.150 km long tunnel will be started in the beginning of the third year and will be completed in the ninth year. Construction of all the major and minor canal structures will also be started in fourth year and will be completed in the ninth year. Also, the lining works of the canal and tunnel will be started in the beginning of the fourth and fifth years respectively and will be completed in the tenth year. The construction of pump houses at various points and the power house at the Musi reservoir will be taken up in the 7<sup>th</sup> year and will be completed by 10<sup>th</sup> year.

## **1.7 Fitment of the Scheme in the Overall Development of the Region**

The Mahanadi - Godavari - Krishna - Pennar - Cauvery – Vaigai - Gundar link proposal will be a boon to the entire peninsular region covering the states of Orissa, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu and Pondicherry. The main aim of the project is to divert the waters from the surplus basins to the deficit basins, for the overall development of the region. For its part, the Inchampalli – Nagarjunasagar link is proposed to serve as one of the carriers from Godavari to Krishna to divert the surplus waters of Godavari besides taking over the commands under Kakatiya canal Stage – II of Sri Ram Sagar Project Stage – II and Srisailem Left Bank Canal. It also meets the domestic and industrial water requirement en route the link. A major portion of the water diverted to Krishna will be further diverted to water short Pennar, Palar, Cauvery, Vaigai and Gundar basins as envisaged in the Peninsular Rivers Development of NPP. Thus, the Inchampalli - Nagarjunasagar link project forms an essential and integral part of the whole Peninsular

Rivers Development Component. And the en route irrigation component of the link would enhance the overall development of the region.

## **1.8 Integrating the Scheme with Neighbouring Basin Schemes**

The Inchampalli - Nagarjunasagar link proposes inter-connecting the proposed Inchampalli reservoir on Godavari with the existing Nagarjunasagar reservoir on Krishna. Also, the scheme proposes to irrigate 178055 ha of area proposed under Kakatiya Canal Stage – II of SRSP Stage – II and 109250 ha of area proposed under Srisailem Left Bank Canal which are already facing water shortage and also divert 14200 Mm<sup>3</sup> into the Nagarjunasagar reservoir. These waters are proposed for further transfer after meeting the deficit in Krishna basin, to the basins viz. Pennar basin area covered by the streams between Pennar and Palar, Palar, Basin area covered by the streams between Palar and Cauvery, Cauvery, Vaigai and Gundar. Similarly, the needs of the water supply schemes en route the canal could also be taken care of.

## **1.9 Inter-state / International Aspects**

The Inchampalli - Nagarjunasagar link project lies entirely in Andhra Pradesh State. However, this link is an integral part of the Mahanadi - Godavari - Krishna -Pennar - Cauvery – Vaigai - Gundar link which envisages transfer of surplus Mahanadi and Godavari waters to the Krishna river and beyond upto Gundar. Hence, a broad consensus amongst the states of Orissa, Maharashtra, Chattisgarh, Karnataka, Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry has to be reached before taking up the project. These interstate aspects are further discussed in Chapter on “Inter-state aspects”. There are no international implications in this scheme.

## **1.10 Cost and Benefits of the Scheme**

The total estimated cost of the link project as per the price level of 2003 - 04 is Rs. 26289 crores. The total cost of head works is estimated to Rs. 1120 crores while the total cost of link canal system, power houses and pump houses works out to Rs. 14636 crores, Rs.2842 crores and Rs. 7691 crores respectively.

The Inchampalli - Nagarjunasagar link is an integral part of the Peninsular rivers development component under the National Perspective

Plan proposals and as such, it will be more appropriate to assess the benefits of Inchampalli - Nagarjunasagar link only after the overall economics of the entire proposal i.e., Mahanadi - Godavari - Krishna - Pennar - Cauvery - Vaigai - Gundar link is finalised, since the benefits from this link project will be realised not only in Krishna basin but also in the basins of Pennar, Cauvery, Vaigai, Gundar and a few other intermediate smaller basins. However, to reflect a broad general idea of the economic viability of the scheme, the B.C. ratio of this link has been estimated on the basis of benefits that may accrue due to irrigation and water supply for domestic and industrial uses contemplated en route the link and the corresponding apportioned cost.

The annual cost works out to be Rs. 541 crores. The net annual benefits from en route irrigation for a CCA of 411872 ha have been worked out to be Rs. 971 crores and that of water supply for domestic and industrial uses to be Rs. 246 crores. Thus, the B.C. ratio works out to be 2.25.