



NORTH EAST COASTAL COMMUNITY DEVELOPMENT PROJECT

Study 16: An Evaluation of the Current exploitation and Demand for Minerals in the Eastern Province and Recommendations to Improve the Current Management and Further exploitation of Mineral Resources in the Eastern Province

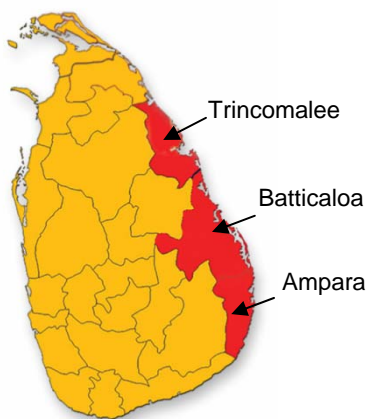
Final Report
September 2010



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North East Coastal Community Development Project (NECCDEP)

An introduction



Project Title : North East Coastal Community Development Project (NECCDEP)

Executing Agency : Ministry of Nation Building & Estate Infrastructure Development

Lead implementing Agency : Eastern Provincial Council

Implementing Agency : 1. Central Environmental Authority (CEA)
2. National Development Trust Fund (NDTF)
3. Ceylon Fisheries Harbor Corporation. (CFHC)

Project Period : 2004 – 2010

Loan No : 2027 – SRI (SF)

Source of Financing	Total Cost (US\$ million)
ADB	20
Govt. of Netherlands	1.5
Beneficiaries	1.3
Govt. of Sri Lanka	5.6
Total	28.4

Goal & Purpose of the project



The goal of the project is to reduce poverty and meet basic needs in coastal communities in the three districts (Trincomalee, Batticaloa and Ampara) of the Eastern province. The project purpose is sustainable livelihood improvement and sound management of natural resources.



Component A Sustainable livelihood improvement
130 GN Divisions are selected for this component. Activities under this component are preparation of village development plans (VDPs), constructing small scale production oriented infrastructures such as minor roads, community buildings, pre schools, drinking water wells, drainages, production centers, fisheries development activities etc, construction of livelihood related cluster infrastructures facilities and providing skill training and micro-credit facilities.

Component B Resource Management in three Special Management Areas (SMAs)
Trincomalee bay, Batticaloa Lagoon and the Southern Ampara biodiversity Zone have been selected for interventions to improve natural resource management and address acute environmental problems. This component includes resource mapping and identification of 'hot spots', formulating SMA management plans and action plans, Implementing community - based natural resource management interventions at the GN level and Implementing larger - scale environmental interventions at the district level.



Component C Coastal Resource Planning

This component includes; Preparation of an overall coastal resource management plan for the Eastern Province, Improving coastal resource management by building capacity for planning and zoning at the provincial, district and division levels and strengthening enforcement authorities, particularly the local authorities and conducting a study of coastal resource management issues in the Northern Province.



Component D Fisheries Development
Rehabilitation of two major fisheries harbors facilities at Valaichchenai and Codbay.



Component E Project implementation Support

Establishment and operation of management & monitoring systems to support timely and cost effective project implementation. Establishment of project office, District project offices, recruiting staff, procurement of vehicle, equipments and furniture, conducting community awareness programmes.



17th September 2010

My Ref: GTC/NECCDEP/ST16/0910/PJ1

Mr. S.M. Croos
The Project Director
North East Coastal Community Development Project,
No. 56, Central Road,
Orr's Hill
Trincomalee.

Dear Sir,

Sub: Consultant's Responses for the comments received from PMU on Draft Final Report

CONTRACT REFERENCE (NEC/PO/TECS(III)/08/16): AN EVALUATION OF THE CURRENT EXPLOITATION AND DEMAND FOR MINERALS IN THE EASTERN PROVINCE AND RECOMMENDATIONS TO IMPROVE THE CURRENT MANAGEMENT AND FURTHER EXPLOITATION OF MINERAL RESOURCES IN THE EASTERN PROVINCE (STUDY 16)

In response to your letter dated 30th June 2010 (NEC/DP/CIII/St/16) for the comments on the Draft Final Report of the above mentioned study 16. We are very much appreciating your extensive comments given on the Draft Final Report and find the responses for your comments lined up as follows and these will be incorporated in the final report;

Final Quality Control Revision

NECCDEP Comment	GTC Response
1. As requested in TOR (a), it is recommended to mention about potential marine (off shore) sand/other mineral resources availability of the province which was not discussed in the report	Potential off shore marine sands, and minerals have not been explored to date, by any individual or organization. Thereby there are no records or texts in this regard
2. Similarly, as requested in TOR (b), a summary of mining production, markets and environmental impacts of major mineral mining locations is to be included. In the report mining production and markets were elaborated only for mineral sands.	Done Other than the mineral sand details, all other given in annex VIII.
3. The presentation of data is generally acceptable; however, district mineral maps should be revised to show relevant mineral occurrences in a more attractive manner. The occurrences with known surface extensions (i.e. Seruwila Cu-Magnetite deposit, certain mineral sand clay, glass sand occurrence etc.) must be shown to scale	Done Corrected maps are attached with the report
4. The Seruwila Cu-Magnetite deposit can be considered an important metallic mineral deposit in the Eastern Province. However, the description given on it in the report is inadequate and it is recommended to elaborate the account with its exploration history (with GSD/BRGM) and a map showing its general extension which would be beneficial for potential future development of the deposit	Done Section 6.12 discuss the relevant information
5. It is recommended to mention location names	Done

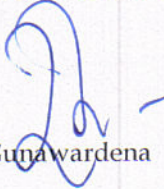
and general GPS data (at centre) for all photos showing mineral occurrences. In page 33, although mentioned in the text, no photo was included to show the Seruwila Cu-Magnetite deposit	Corrections are in the section 7
6. Reference for some citations were not given or inaccurate (e.g. Geological map of Sri Lanka at Page 14). A list of references should also be given	Done References are corrected and all references are given in the section of references

On behalf of the Consulting team and the Team leader, we wish to thank NECCDEP - PMU, the district DPDs and GSMB for the excellent cooperation extended to us with their comments.

If you have any further clarification please free to contact me on 0772 482 725 or Mr. Prasad Jayaweera on 0773 469 189.

Thank you

GREENTECH CONSULTANTS (PVT) LTD


Diyath Gunawardena
Director

Citation:

GreenTech Consultants (2009), An evaluation of the current exploitation and Demand for minerals in the Eastern Province and Recommendations to improve the current Management and further exploitation of mineral resources in the Eastern Province, Final Report, Pp55, September 2010, NEC/PO/TECS(III)/08/16, NECCDEP/GreenTech Consultants, ADB LOAN 2027 SRI (SF): North East Coastal Community Development Project (NECCDEP).

Colophon

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CBO	Community Based Organization
CCD	Coast Conservation Department
CEA	Central Environmental Authority
CGD	Coast Guard Department
DS/GA	District Secretary/Government Agent
DS	Divisional Secretary
EDB	Export Development Board
ERS	Electrical Resistivity Surveys
GN Division	Grama Niladhari Division
GoSL	Government of Sri Lanka
GPS	Global Position System
GSMB	Geological Survey and Mines Bureau
GTC	GreenTech Consultants
IA	Implementing Agency
IFS	Institute of Fundamental Studies
MPN	Most Probable Number
NECCDEP	North East Coastal Community Development Project
NEPC	North East Provincial Council
NGO	Non Governmental Organization
PMU	Project Management Unit
SMA	Special Management Area
ToR	Terms of Reference
TL	Team Leader
UDA	Urban Development Authority

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EXECUTIVE SUMMARY

The Terms of Reference (TOR) provided by NECCDEP requires addressing the following main areas of study which include an evaluation of the current mineral exploitation and its demand. In addition to this it is required that guidelines are provided to improve the current management, for further exploitation of mineral resources in the Eastern Province. Rock resources of economic potential are also included in this study, as required by NECCDEP. As per TOR, sands in general and **mineral sands are of focus**. In addition it is required that the current status of exploitation, its present exploitation, and future demands both nationally and internationally are summarized.

After the initial desk study to collect secondary data for the Inception Report, rapid reconnaissance surveys were undertaken in all three districts of the Eastern Province by the team of Consultants. In the field studies a total of **12 separate mineral categories** were identified as given in this report. Of these only a few are currently being exploited, whereas potential exists for further economic development, for the benefit of the NECCDEP Community. Such exploitation will have markets outside the province, if proper management is established by the relevant Government Authorities, along with a marketing arm. Other than exports of mineral sands, from the 12 mineral resources that were identified and are covered in this report, a majority will have a demand both within the province and outside, especially when taking into consideration the rapid infrastructure development programmes that will take place during the “post war” rehabilitation, within the next few years.

The tabulations provided in this report provide **specific mineral occurrences** most of which remain today untapped or under utilized. The GPS readings of these resources are provided, along with professional comments, with **GIS maps** indicating such deposits. This data base will need the attention of the decision makers to evolve an overall plan for further exploitation, based on market demands only, in order to ensure that **reserves** also remain for future exploitation.

The team of consultants decided to proceed **well beyond the scope of the TOR** to cover **all mineral** resources of the NECCDEP area, because **all minerals**, (except for groundwater and mineral sands) are a **non renewable resource**. A national wealth, which needs planning at the initial stages, for sustainable development, for a multidisciplinary forum, along with Government Agencies, especially in the issue of Licenses for mining.

Emphasis was placed on mineral sands in the TOR, and therefore studied in detail. The visit to the Pulmuddai area/ factory/ interview with G.M (Sri Lanka Mineral Sands Ltd), indicated that there is a saturation point for exports internationally. A limitation exists for beneficiation of end products, such as Ilmenite, Rutile, Zircon, Garnet etc. However during the reconnaissance survey a number of beach mineral sands were identified along the coast of the Eastern Province, mainly of a small extent with high mineral sand potential. For such deposits initial basic screening is recommended by periodic top shaving. For final separation the products should be delivered to a main mineral sand separating plant, such as at Pulmuddai.

SECTION 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

GreenTech Consultants (Pvt) Ltd has been contracted by NECCDEP (North East Community Development Project) to carry out the consulting services for an Evaluation of the current exploitation and Demand for minerals in the Eastern Province and Recommendations to improve the current Management and further exploitation of mineral resources in the Eastern Province. This Interim Report addresses the detailed work scope, methodology and client's expectations which will be addressed by the consulting team during the contract period of 4 months.

The North East Coastal Community Development Project (NECCDEP) is designed to assist vulnerable communities in the Eastern Province to improve their livelihoods, meet basic needs, and strengthen community management of natural resources; NECCDEP under Technical Studies (Component III) has identified this mineral resources study as an important component of natural resources in the Eastern Province.

1.2 North East Coastal Community Development Project (NECCDEP)

The Government of the Democratic Socialist Republic of Sri Lanka (GOSL) has received a loan from the Asian Development Bank (ADB) towards the cost of the North East Coastal Community Development Project (NECCDEP). The NECCDEP objective is to reduce poverty and meet the basic needs of the coastal communities in three districts (Trincomalee, Batticaloa, and Ampara) of Eastern province. The purpose is sustainable livelihood improvement & sound management of natural resources.

The ADB-funded North-East Coastal Communities Development Project (NECCDEP) is undertaking a variety of initiatives to develop coastal communities in the North-East, including small-scale infrastructure development, fisheries development, coastal resource management and sustainable livelihood improvement. However, in order to be sustainable, all of these initiatives need to be based on effective planning that reflect the priorities of the local people and ensures that they take responsibility for developing their own communities as mentioned above.

The present focus of sustainable development has shifted from the ecological perspective to include economic and social sustainability. This has been developed further in the concept of sustainable livelihoods which have now been adopted by a number of agencies, NGOs and governments. The livelihood approach puts people at the centre of development. This focus on people is equally important at higher levels as it is at the micro or community level. A main component in the journey of sustainable development in countries like Sri Lanka is the lack of Participatory Planning. This links the development with human needs and wants. Participatory planning approaches, aim at strengthening the local capacity for sustainable development in terms of knowledge, skills and organization. One of the important ways to ensure that local capacity is improved through the recognition of the appropriateness of local knowledge in designing project actions. The second assumption is that the use of participatory approaches will allow the integration of local knowledge systems into local project planning and implementation. The project then complements these knowledge systems with technical support for the development of appropriate technical menus. Therefore, in particular during the planning process, emphasis should be put on the mutual assessment and mobilization of local knowledge and management systems.

Since the project commenced in early 2005, it has been working with communities and a range of local NGOs to develop Village Development Plans in its' target villages. These plans have already been used to identify a wide range of priority interventions to develop the

local infrastructure including village roads, culverts, community halls and irrigation. In early 2006, the project also began work on setting up Livelihood and Enterprise Development Services and a Micro-Credit Scheme to support people in coastal communities to enhance and diversify their livelihoods.

The project has five components, which are as follows:

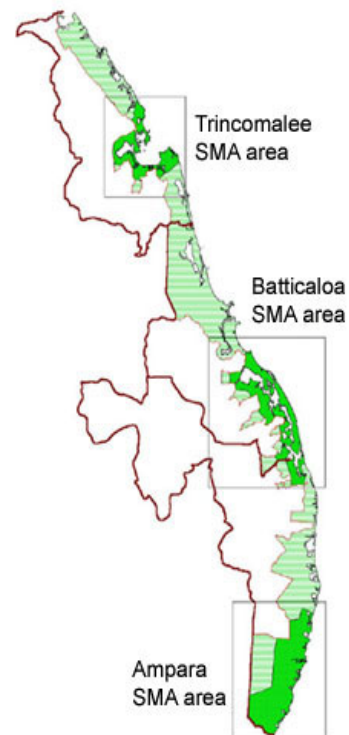
1. Sustainable Livelihood Improvement
2. Resource Management in Three Special Management Areas (SMAs, Trincomalee Bay, Batticaloa Lagoon, and Southern Ampara Bio-Diversity Zone)
3. Coastal Resource Planning
4. Fisheries Development
5. Project Implementation Support

In this respect the NECCDEP wishes to carry out Technical Studies under the component of Resource Management in Three Special Management Areas and Coastal Resource Planning:

Component II: Resource Management in Three Special Management Areas

The following three Special Management Areas (SMAs) have been identified for interventions in order to improve natural resource management and address acute environmental problems such as

- (a) Trincomalee Bay – Pollution sources, shore line erosion and coastal resource degradation
- (b) Batticaloa Lagoon – over exploitation of its resource and pollution
- (c) Southern Ampara Bio-diversity zone. It has significant potential for tourism and fisheries development.



Source: NECCDEP web

Integrated planning and subsequent management of the SMAs at District level is undertaken by the SMA Committee established at each district under the chairmanship of the District Secretary. The Central Environmental Authority assists in the preparation of a SMA Plan for each District.

This Specific project deals with the following Studies on these three special Management Areas:

1. Sand Dune Topography and land use patterns in the Potuvil & Lahugala DS Divisions
2. Seasonal variation in water Quality in the Arugam Lagoon, Including the identification of the most likely sources of key pollutants assayed and recommendations to improve the future water quality of the lagoon
3. A study of soil erosion in chena cultivation areas in the Potuvil and Lahugala DS Divisions and Assessments of the potentials for agro –forestry demand for fuel wood in the area
4. A participatory Assessments of the dynamics seasonal variation and current status of the fishery in the Batticaloa Lagoon

5. Seasonal Variation in water quality in the Batticaloa lagoon, including the identification of the most likely sources of key pollutants assayed and recommendations to improve the future water quality in the lagoon
6. improve surface water drainage in the Pottuvil Town
7. Preparation of an initial environmental examination report and detailed design for the proposed composting plant to improve the existing dumping site at Kanniya in the Trincomalee District
8. Preparation of an initial environmental examination report and detailed design for the proposed composting plant to improve the existing dumping site at Thirupperumthurai in the Batticaloa District
9. A bathymetric survey of Batticaloa lagoon.
10. An assessment and critical evaluation of the potential pollution impact of current land use practices, on the Batticaloa lagoon.

A. Component III: Coastal Resource Planning

The Eastern Province prepared and established a consistent framework for provincial coastal resource planning and management.

The plans, among others, encompass shoreline management and tourism development in the coastal zone. The project improves the capacity of local government agencies to undertake planning, coordinate aid agency interventions, prepare natural resource plans and efficiently integrate these plans into specific sector and overall development plans.

This Specific project deals with the following Studies on Coastal Resource Planning:

1. An assessment of the past and current extent of mangrove coverage in the Eastern province of Sri Lanka, Using Remote sensing technology.
2. An assessment of the change in shoreline location along the coast of the Eastern Province of Sri Lanka, using Remote sensing technology.
3. A narrative and visual inventory of heritage sites, religious festivals and cultural groups in the coastal area of the Eastern province of Sri Lanka.
4. An analysis of the current and future economic value of coastal resources in the Eastern province.
5. **An evaluation of the current explanation and demand for minerals in the Eastern province and a recommendation to improve the current management and further exploitation of mineral resources in the Eastern province.**
6. An assessment of the potential and current constraints for the promotion of “Bird Watching” and nature tourism in the Eastern province.
7. A review of the coral reef on the East coast of Sri Lanka: Distribution, ecology, status and threats.
8. A review of the historical and current status of the fisheries sector along the Eastern coast of Sri Lanka

This study is an evaluation of the current explanation and demand for minerals in the Eastern province and a recommendation to improve the current management and further exploitation of mineral resources in the Eastern province.

SECTION 2: THE STUDY & PROJECT AREA

2.1 Justification of the Project

In the coastal sector of the Eastern Province the main economic mineral resource is mineral sands. At present the coastal mineral sands are exploited only at Pulmuddai, which has been an on going project since 1963, and managed, by the Mineral Sands Corporation of Sri Lanka. However smaller deposits of mineral sands do exist along the eastern coast, and a well identified deposit can be seen at Thirukkovil. In the context of the TOR this consultancy will need to identify limited small scale beach mineral sand deposits for future resource beneficiation potential. An industrial mineral separation plant exists only at Pulmuddai, which is fed by the beach sand deposit at site. The separation technology here involves gravity separation by a winfrey table using fresh water in large quantities, fed by Yan Oya. For final fractions Electromagnetic Separation is also used for beneficiation. The separated minerals are mainly Ilmenite Rutile, Zircon, and Garnet. To a lesser quantity Sillimanite Badelleyite and Monazite will be found. Presently Zircon has a local demand for the ceramic Industries for use as glazes. The balance fractions have had export potential, where the main market has been Japan.

In addition to mineral sands, the interior sectors of the Eastern Province have in-situ occurrences of economic minerals. These have been recorded in maps of mineral occurrences, and also in Geology maps published by the Geological Survey and Mines Bureau (GSMB). In the past only a few such deposits have been mined, mainly by manual methods to supply a few mineral based industries, such as ceramics.

Also significant clay deposits of economic potential do exist in the Eastern Province. Limited industries such as Brick, Tile, Pottery and decorative Earthenware use these clay deposits mainly on a cottage industry scale. These clay deposits have potential for future industries in the district. It is not evaluated as yet as to whether these clays are suitable for the production of exotic Stone Ware, which has a good export market. Perhaps Bone China can be another export product from particular clays, with an imported input of bone-ash, as an ingredient of the body mixture.

In the TOR another area mentioned is Kinniya. The significant mineral here is water-viz the famous "Hot Water Springs" This occurrence is along a Geological Boundary between the so called Vijayan Complex and the Highland Series of Sri Lanka. There are reports of researches on the existing status of hot water including data of Electrical Resistivity Surveys (ERS). In 2009 the Institute of Fundamental Studies (IFS) undertook a study of Geothermal Energy along this Geological Boundary. This can be vital in the scenario of carbon dioxide emissions on traditional fuels, especially hydrocarbons, which has increased the need for alternatives to curtail global warming.

In addition to thermal water, significant, fresh **ground water resources** were also examined during field visits. Such resources can be considered for limited water supply schemes and for irrigation of cash crops.

Also elevated quartzitic **gravel deposits**, which is a major resource for highway construction, and for landfills were also examined.

Common salt (NaCl) which is also considered a mineral was examined during field visits. Existing and abandoned salterns were visited in order to assess the present exploitation and future potential.

Deposits of **Silica sands** (SiO₂) were also visited during the field surveys. These are mainly elevated windblown sands. The potential exists to use this sand for the construction industry and also for surfacing and pavements in highway construction.

Economic rock resources, such as **existing and potential quarry sites** are included in this study, for future exploitation. Also the **copper magnetite occurrence** at Seruwila was within the scope of field visits. The mining concepts are discussed by our team Mining Engineer.

During the tenure of this study field visits will be undertaken to specific areas after the collection of secondary data from relevant agencies. Thereafter it will be possible to analyze the following main criteria such as –

- Current Exploitation
- Demand for minerals of the Eastern Province
- Current Management
- Further exploitation
- Recommendations

2.2 Aim of the study

To provide support to the Provincial Planning Unit, the NECCDEP and other development agencies to generate a clear understanding of the current status of minerals, an assessment of the potential for further expansion of mineral mining activities in order to enable planners at the provincial, district, divisional and local government level.

2.3 Objectives of the study

To provide an overview of the current status of mineral mining in the Eastern Province and an assessment of the potential for further expansion of mineral mining activities to enable planners at the provincial, district, divisional and local government level to make technically informed decisions in respect of licensing and/or promoting mineral mining operations in the eastern province.

2.4 Scope of Work

The expected scope of work is specified in the TOR provided by the NECCDEP. In this content the main goals expected for the Eastern Province in the study will be as follows,

- I. Review all available data on mineral deposits, available with different agencies.
- II. Production and movement of mineral sands
- III. Identification of major mineral deposits, and known mineral mining locations
- IV. Conducting a rapid assessment of mining locations in terrestrial, revering and marine environments, and estimate quantities of minerals currently mined
- V. Establishing the status of each mining operation and evaluating the current impact at each location
- VI. Summarizing the current status of exploitation of minerals in the Eastern Province from secondary data
- VII. Reviewing the past, present, and future for minerals internationally, nationally and at local level
- VIII. Preparing guidelines to improve the management, and exploitation of existing major and minor mineral deposits
- IX. Recommendations for any possible expansion or diversification for mineral mining in the Eastern Province

Also special emphasis is required for commercial mineral sand mining and its beneficiation at Pulmuddai, and also the un-mined well known mineral sand deposit at Thirukkivil. In

addition there may be smaller, unexplored deposits of mineral sand along the Eastern Province coastal belt, which could be identified during the reconnaissance surveys.

The guidelines to be provided will enable planners at local, divisional, and district levels to make informed decisions in granting permission for mineral exploration and sand mining in concurrence with the GSMB. The environmental impacts will need to be considered especially in the mining of beach sands.

The draft final report will provide the above contents district wise within the Eastern Province, which includes the districts of Trincomalee, Ampara, and Batticaloa.

2.5 The study Area

The Eastern Province covers an area of about 10,000 square kilometers, which is about 15% of the total land area of the country. The province comprises of three districts, the largest is the district of Ampara with an area of about 4,400 sq. km. The other two districts are more or less equal in area with the district of Batticaloa having a slightly larger area of about 2,850sq.km, while the district of Trincomalee has an area of 2,700sq.km. The topography of the province is relatively flat in the coastal areas and undulating in the western part of the Province. The landscape of the Province is varied, with paddy fields, forests, scrublands, mineral sites, wetlands and lagoons being predominant.

Although the Eastern Province is geographically large, the project study area is limited to the coastal area which is defined as Divisional Secretary divisions which are directly located along the sea or the lagoons. Accordingly, there are 33 DS divisions includes the east coast of Sri Lanka. The following map shows the potential mineral sites of the East Coast of Sri Lanka.

The area of study specified by the NECCDEP, which will involve the following Divisional Secretarial Divisions of Trincomalee, Ampara, and Batticaloa of the Eastern province. These divisions are provided in **Table 1**.

Table 1: Coastal Divisional Secretarial Divisions of Trincomalee, Ampara, and Batticaloa of the Eastern province

District	Coastal Divisional Secretaries Divisions (DSD)(1)	Area	
		Km ²	%
Trincomalee	Kuchchaveli	313.3	5.39
	Town and Gravets	148.0	2.55
	Thampalagamam	244.4	4.21
	Kinniya	146.9	2.53
	Muthur	179.4	3.09
	Seruvila	377.0	6.49
	Verugal/Eachchalapattu	98.0	1.69
	Sub Total	1507.0	25.94
	Batticaloa	Koralai Pattu North	550.0
Koralai Pattu, Pattu W (4)		660.5	11.4
Eravur Pattu		634.2	10.9
Eravur Town		3.7	0.1
Manmunai N		75.1	1.3
Manmunai W		292.7	5.0
Kattankudy		3.9	0.1
Manmunai Pattu		31.7	0.5
Manmunai SW		161.6	2.8
Manmunai S, Eruvil Pattu		52.5	0.9
Porathivu Pattu		167.2	2.9
Sub Total		2633.1	45.3

Ampara	Kalmunai Tamil, Muslim	57.9	1.0
	Navithaveli	57.7	1.0
	Sainthamaruthu	9.0	0.2
	Karaitivu	31.3	0.5
	Ninthavur	55.6	1.0
	Addalachchenai	52.5	0.9
	Akkaraipattu	102.2	1.8
	Alayadivembu	127.5	2.2
	Thirukkivil	190.6	3.3
	Pottuvil	367.5	6.3
	Lahugala	616.9	10.6
	Sub Total	1668.7	28.70
Total for all EP coastal DSDs		5808.8	100.0
Total for Eastern Province		9791.2	59.3
Total for Sri Lanka		65610.0	8.90.0

It was decided by the consultancy Team to provide the mineral occurrences on 1:50,000 Topographical sheets of the Survey Department. Our cartographer (from GreenTech Consultants) plotted the occurrence based on GPS readings, which is given as an annexure (Annexure - VII) to this report, as GIS maps.

The following annexure provide identified mineral occurrences on a district wise basis.

- Annexure I - Mineral occurrences covering Trincomalee District
- Annexure II - Mineral occurrences covering Batticaloa District
- Annexure III - Mineral occurrences covering Ampara District

In the above tabulated Annexes the mineral and rock resources of importance are given as follows:

1. Mineral sands
2. Construction sand (River & Dune sands)
3. Manufactured construction sand (from elevated Quartzite ridges)
4. Glass sand
5. Metal Quarries (working & abandoned)
6. Gravel Resources (mainly Quartzitic and pegmatitic gravel)
7. Brick (tile) clay
8. Potable Ground water.
9. Thermal water (Hot water spring at Kinniya)
10. Salterns (existing/abandoned/proposed)
11. Lime manufacture. (From shell Beds)
12. Copper – Magnetite Ore (deposit of Seruwila)

In the tabulated **Annexes I, II, and III** the above **twelve categories** are discussed under the **Remarks Column**, where the status and extent is highlighted. These **Annexes I, II and III** also revised as **Annexes IV, V and VI** based on different mineral categories. Also environmental considerations are discussed due to unprofessional mining carried out at present. In addition these tables discuss the availability of potential reserves, especially the economical grade of mineral sands.

The Annexes also provide the economical viability of the twelve categories listed above, along with recommended and existing Mining Licenses as issued by the GSMB, under Industrial Mining Licenses [IML].

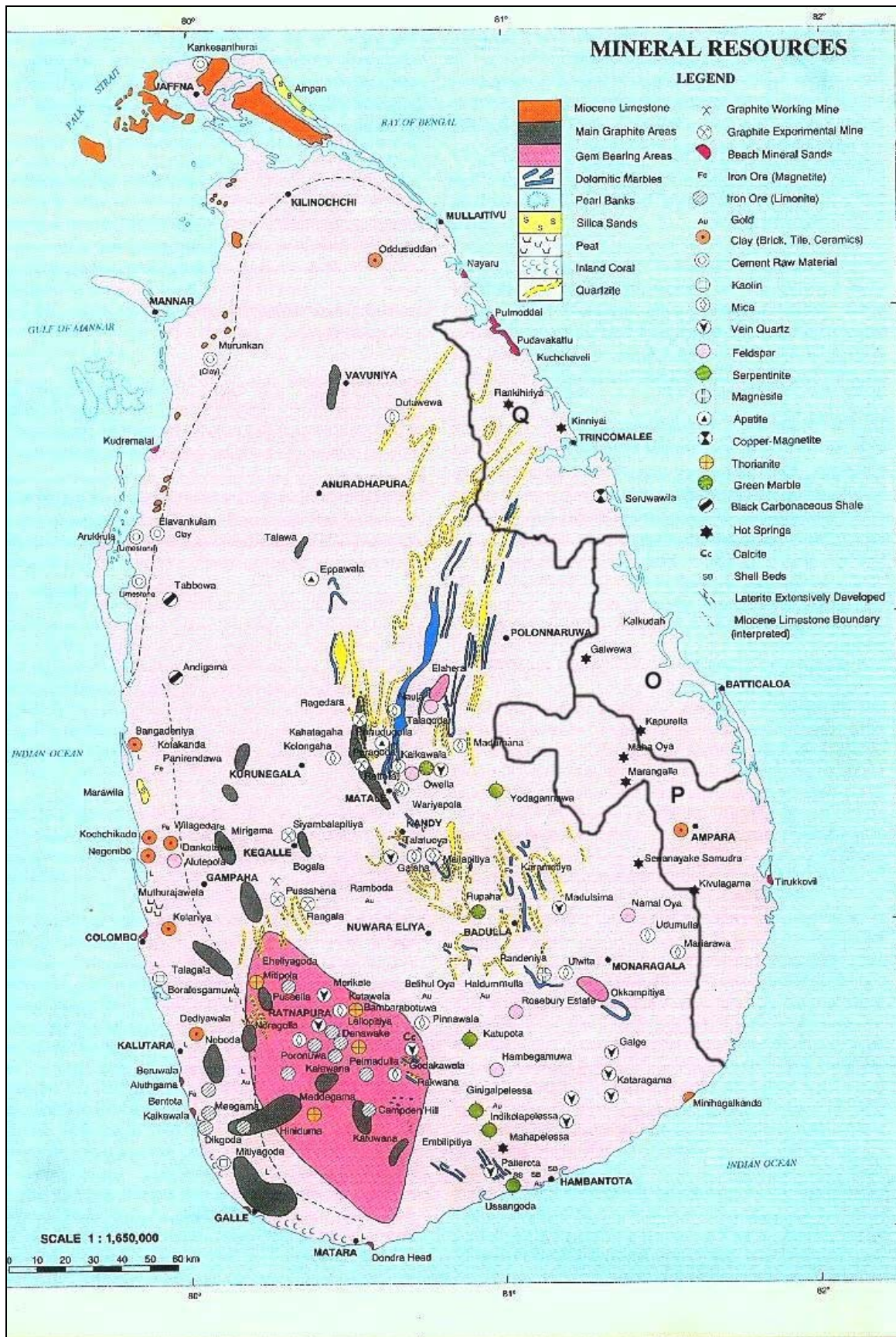


Figure 1: Mineral Map of Sri Lanka, GSMB

SECTION 3: METHODOLOGY

The initial approach as per TOR was the collection of all available “**secondary data**” from all relevant agencies, for the desk studies and initial evaluations. The main agencies for such data collection were;

- Geological Survey and Mines Bureau (GSMB)
- Institute of Fundamental Studies (IFS)
- Department of Geology, University of Peradeniya
- Survey Department of Sri Lanka
- Central Environmental Authority

Letters of request to the above Authorities were required from the client (NECCDEP) for this data collection activity. The main agency for data collection was the **GSMB**, where the following documents were referred to.

- Mines and Minerals Act, No.33 of 1992
- National Mineral Policy, Sri Lanka of 1999
- Sri Lanka Minerals Yearbook (the most recent)
- Geology Maps 1:50,000 or 1:100,000

From the Survey Department the following maps were made available.

- 1:50,000 topographical Maps of the Study Area
- The map of the Eastern Province on a good scale

The above secondary data were used for the desk studies and an overall interpretation. Specific field visits to sites were undertaken thereafter on a reconnaissance basis to identify and comment on the specific resources within the area of study.

The TOR specifies in a Mineral Study. A rock is an assortment of minerals. There are significant rock resources of economic potential in the Province, for both construction and other usage. **Rock resources** are included for the study. Therefore the scope of studies was significantly enhanced. At the request of the NECCDEP an experienced mining engineer was also engaged for this study.

SECTION 4: PHYSICAL AND GEOLOGICAL SETTING**4.1 Physical Setting ((for rapid assessment of mineral resources))**

The origin of metallic group and many non-metallic group minerals of the eastern province of Sri Lanka are related to hard basement rock. These mineral resources derive as in situ and others are due to denudation. Denudation indicates the process by which the removal of material through means of erosion and weathering, leads to a reduction of elevation and relief in landforms and landscapes, and accommodates to form sedimentary layers. In this respect, a brief discussion on climate, properties of vegetation as well as surface morphology in the coastal DS Divisions of the Eastern Province is required.

The climate experienced during a 12 month period in Sri Lanka has been categorized into 4 climatic zones. Based on these, Sri Lanka has divided into 3 climatic zones, namely Dry, Intermediate and Wet (Survey Department of Sri Lanka, 2007). Accordingly, the Eastern Coastal DS Divisions belong to the Dry Zone, and the Monthly Mean Temperature (MMT) exceeds 27.5°C from April to October. However from November to October the MMT varied between 25.0°C and 27.5°C but in the Ampara District the Mean Temperature of March varies between 25.0°C and 27.5°C and in the Districts of Trincomalee and Batticaloa the Mean Temperature of March exceeds 27.5°C

Likewise, four seasons have been recognized in the rainfall calendar of Sri Lanka based on the monsoons. During the Southwest Monsoon, the Districts of Trincomalee and Batticaloa receive a Monthly Monsoon Rainfall (MMR) of 250mm to 500mm and the Ampara District receives MMR of 100-250mm. However during the Northeast Monsoon, the MMR received (except Muthur area) is 500-1000mm.

In this area, 36 river basins (River, Oya or Aru) have outlets, which release water to the sea or lagoons or lakes. Mostly these originate from the Central Highlands, Knuckle Massif and Namunukula Hills. They supply a considerable amount of alluvium to the flood plains and sand (quartz and mineral sands) for beach nourishment.

Dry monsoon forests are the dominant natural vegetation of the study area. Most of the brackish and saltwater environments and sand dunes are covered by maritime vegetation, mainly mangroves, salt marshes and littoral vegetation. Likewise, along the rivers, associated water courses and abundant tanks, riverine vegetation is dominant. The areas, where the dry monsoonal forests have been cleared for chena cultivation and abundant residential plots are covered up by bushes, scrublands and grasslands. These ecosystems of the coastal DS Divisions of the Eastern Province create ecological niches for mammals, avifauna, reptiles, amphibians as well as fishes (fresh, brackish and marine). They supply these ecological niches as shelter and breeding grounds for them.

The coastal zone from the Kokkilai Lagoon (Trincomalee District) to Kumana Villu (Ampara District) was investigated for the rapid assessment of mineral resources in the Eastern Province of Sri Lanka. Based on coastal configuration, landforms and the constituents of the deposits, the coastal stretch has been divided into several coastal sectors as described by Swan, 1984. A bay and headland coast is present to southward, but the headlands are smaller and protrude out to the sea less, while the zone of sedimentation behind the coastline becomes wider. Between the outfalls of the Kokkilai Lagoon and the Yan Oya, concentrations of heavy minerals, mainly ilmenite and rutile are abundant. They lie both onshore and offshore. Inland, they occur as dunes and raised beach deposits. The greatest concentrations are in a belt encompassing the beach and breaker zone between the outfalls of the Kokkilai lagoon and the Yan Oya. Pleistocene sands that lie beneath the shore zone suggests either that during the Pleistocene concentrations, were lower due to a smaller supply, or that the shoreline, where waves concentrate heavy minerals, was elsewhere.

Similarly, coral deposits, which occupy an area of about 2.5 km² about 0.5 to 1.5 km inland near Irakakandi, bear further testimony to shoreline changes in the area.

From the Yan Oya outfall to the Koddiyar and Trincomalee Bays, a bay and headland coast again backed by raised beaches, lagoons, ill-drained alluvial flats and low residual rises with occasional narrow ridges trending northeast gives this tract its character. Some of these ridges reach the sea as bold headlands. Other headlands are broad capes of low coral that succumb more readily to the rough seas of the northeast monsoon. During the Holocene transgression, much of the area associated with this coastal tract was submerged. Above it raised many islands, hold ridges as at Trincomalee, and low rises and plateaux. The lower Mahaveli valley was under water then, but was later filled in, giving rise to the present patterns of estuaries, deltas, bay head barrier beaches and lagoons.

The shores of the Koddiyar bay are zones of interaction among processes related to fluvial deposition, tides and refracted waves entering the semi-circular bay. In the Tambalagam Bay, west of the Koddiyar bay and all but cut off from the sea by barrier beaches and some of the ridges of the Trincomalee Harbour, sedimentation by fluvi-organic processes is very active. The harbour of Trincomalee with its many deep coves and inlets receives no river sediments and therefore retains its highly indented character.

From Foul Point to Kalkudah, broad embayment backed by raised beaches, lagoons between two systems of barriers, and lowlands, form the outer part of this coastal zone can be seen. Further inland, lies a low belt of residual terrain, about 8 km wide, and beyond it is the flood plain of the lower Mahaveli River. A tributary of this river empties north of Kathiraveli, and has obliterated the inner barrier in so doing. The outer barrier by contrast, is well developed, and is so well endowed with sand that it deters the Mahaveli from emptying into the sea along this coastal sector. Almost certainly, that river once discharged more of its water this way, as its deposits have given rise to older alluvium about 8-10 metres above sea level seen abundantly in the northern half of this sector. This indented stretch of coast consists of a series of bays and headlands, backed by beach ridges, lagoons, zones of sedimentation and low residual terrain around the Velikuda Periya Munai Point - Kalkudah area. The headlands are all of coral and are being slowly but steadily pushed back by the sea. This zone is also intensively mined for coral. Northeast of the Velikuda Periya Munai Point, a bare, small coral island rises over 2m above MSL and points to a period of higher sea level.

From Kalkudah to the Batticaloa lagoon outfall, along this pro-graded tract, beach ridges occupy a swath up to 4 km wide. Lagoons have been confined to relatively narrow bands, parallel to, and between the beach ridges and an old shore line of residual materials. The main outlet of the Batticaloa lagoon has been moved from Batticaloa to its present position 5 km further by spit extension. The coast is pro-graded and consists of a sand belt up to 6 km wide. The coastline is concave in plan and associated with a broad, stable beach.

Between the Batticaloa lagoon outfall and Kalmunai, beach rock is exposed, where barriers between the lagoon and the sea have been breached by runoff, as at Kodaikallar, 8 km north of Kalmunai. Remnants of an older, inner barrier system of raised beaches, lie about 1 - 3 km inland of a wide outer system, with lagoons or their traces behind each. The outer barrier, though presently straight to gently convey in plan, is associated with ach ridge systems that appear to have once developed concaves seawards, with reference to offshore bars or rocks and one-time headlands which have been destroyed. A submerged reef of coral on beach rock parallels the shore from opposite Putukuyiruppu to opposite Uppodai.

At Kalmunai there is a change in the coastal plan shape. Although convex to the south, the coastline becomes concave north of Kalrnunai. Beach ridge patterns suggest that this plan shape had been persistent during the building of the sand barrier here. A reef stands below

the surface offshore, and probably was a headland at sometime, later truncated by wave action, and which served as a pivot with reference to which beaches grew. The spot where this change in the shoreline plan occurs is unstable and suffers recurrent retreat. From Kalmunai to the Sangamakande Point the coastline changes alignment and trends southwards. Residual landforms become exceptional near the coast. Instead, flood plains, with distributary systems that commence as high as 35 m above sea level, and as far as 25 km from the coast, and other features such as river terraces, large lakes and lagoons are predominant. The principal river here is the Gal Oya. Sand dunes diminish or disappear, because during the dry season sand is most readily blow offshore, by winds.

The coastline consists of barrier beaches of varying widths, which increase in the northern part of this sector. Those further south have undergone considerable recession and re-development. Two reefs of beach rock, an outer and an inner, run northwards from Tirrukkovil. The outer crests at depths of 5-6 m below MSL. The shape of the coastal plan suggests that the coastline has not attained substantial stability in the face of the prevailing shore processes and that it is erosion prone in Places.

Flood plains and depositional tracts of the coastal stretch from the Sangamakande Point to the mouth of the Kubukkan Oya are wider and lagoons and lakes are of a greater size. Red and yellow latosols similar to those in the north and northwest of the island cover a small area here. Two submarine ridges, Egeriya Patch and Komariya Ridge which rise within 5-6m and 13-15m of MSL respectively, lie skew to the coastline and mark stages in the post-glacial transgression here. They appear to be composed of calcareously cemented sandstone and mark the positions of former spits. Their alignments indicate that they originated from the southeast to northwest.

4.2 Geological Setting

Geologically, nine-tenths of Sri Lanka is made up of highly crystalline hard metamorphic basement rocks of the Precambrian age. This Precambrian basement can be divided to the following metamorphic sub-divisions.

- Vijayan Complex
- Highland Complex
- South Western Group
- Wannu Complex

In the NECCDEP study area mainly the following will apply to the three districts, where basement rocks and outcrops are concerned.

- Highland Complex – **Trincomalee District**
- Vijayan Complex – **Batticaloa and Ampara Districts**

This is shown in the Geology Map of Sri Lanka in **Figure 2**, on the above distribution.

The **Highland Complex** of highly metamorphosed rocks in the Trincomalee district can be seen in the following main rock types

- I. Quartzites and Quartz Schists
- II. Charnockites and Charnockitic Gneisses
- III. Crystalline Limestone and Calciphyres
- IV. Biotite Gneisses
- V. Hornblende Biotite Gneisses
- VI. Migmatites and Migmatitic Gneisses
- VII. Granitic Gneisses and Pegmatites

This Highland Group of rocks is in general folded, to a system of long parallel folds. The general direction of these folds lies between North to South and North-west to South-east (Cooray, P.G. 1984), and near Trincomalee they run North-East to South-West.

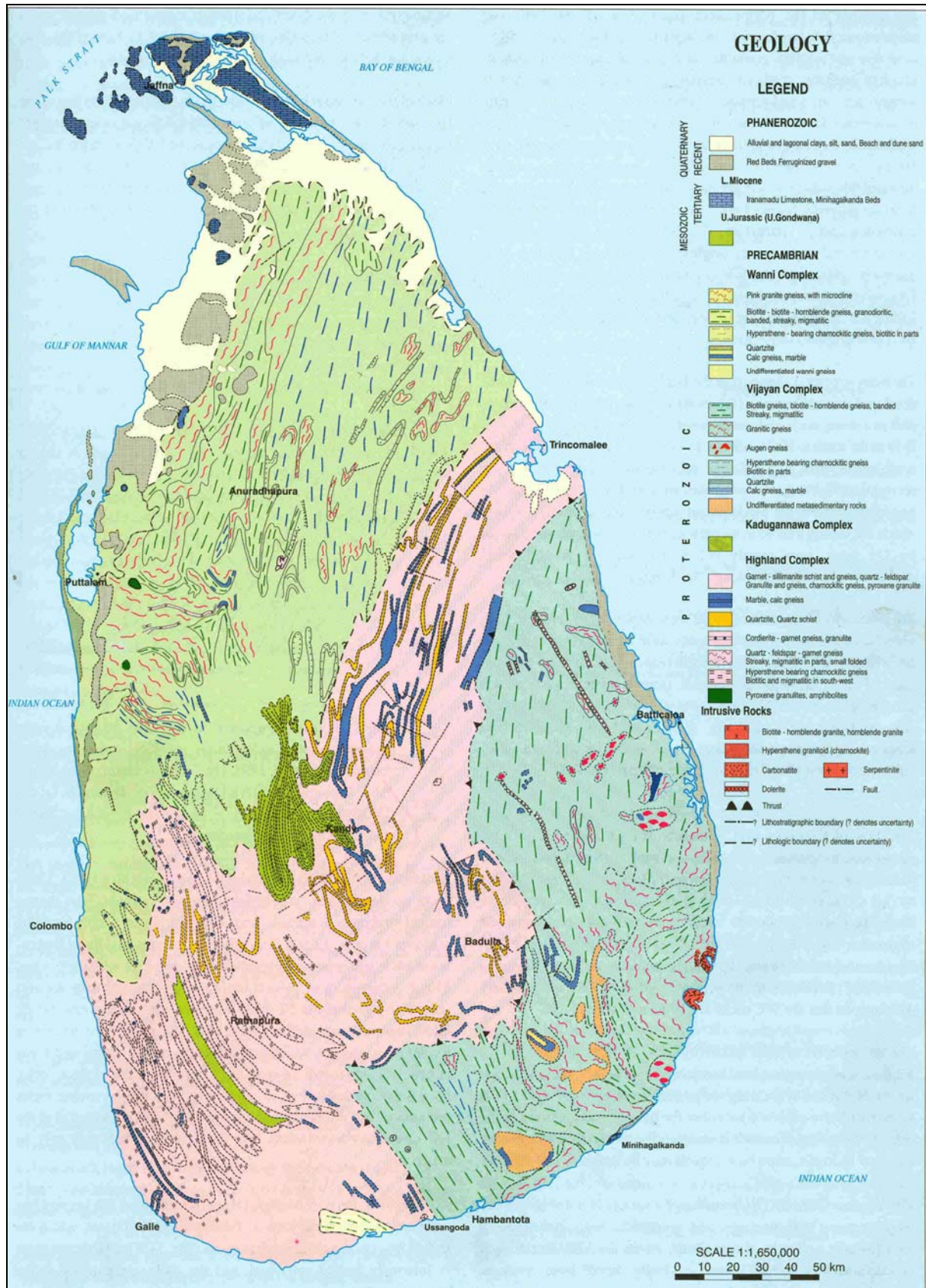


Figure 2: Geological Map of Sri Lanka, Cooray, 1984

In contrast the folding of the Vijayan Complex is very irregular and there is no clear pattern of continuous parallel folds. This can be followed for relatively short distances, and vary in direction within small areas, indicating very poor structural control. However, small bodies of granite and Dolerite dykes exist especially in the Trincomalee District. The rock types of the **Vijayan Complex** include the following.

- I. Biotite Gneisses
- II. Migmatites and Migmatitic Gneisses
- III. Granitoid Rocks and Pegmatites
- IV. Charnockitic Gneisses
- V. Variety of Metasedimentary Rocks.

Geo-morphologically all three districts of the NECCDEP area falls into the so called "**Lowest Peneplain**" of Sri Lanka which has an average height of less than 30 meters Wadia (D.N.1945). This vast plain is the result of millions of years of sub aerial weathering of the ancient, highly folded landmass of crystalline rocks. The original landscape has been levelled out, except for erosion remnants that stand out as isolated hills called "Inselbergs".

Especially in the **Ampara District** these erosion remnants have stood out against the levelling Process, due to resistant **Granitic Rocks** which contain **large proportions of Quartz**, which is one of the most resistant rock forming minerals (Cooray P.G. 1984). "Such as Wadinagala (2400 feet) the highest point in the entire Eastern Province. In the Trincomalee District of the NECCDEP area, the most resistant rocks will include Charanockites and Quartzites.

In all three districts there are criss-crossing pegmatites across the rock structure. Most of these pegmatites have economic potential such as –

- Gravel resources
- Economic Minerals
- Ore resources (e.g.: Copper – Magnetite deposit at Seruwila)
- Groundwater Resources

It is important to recognize that it is by the weathering process of the metamorphic crystalline rocks that sand deposits accumulate along the Eastern Coast of the NECCDEP area. The products of weathering are brought to major river mouths especially during the monsoonal periods. These sands are sorted by prevailing current patterns of the Eastern Coast with tidal fluctuations and deposited on the beaches, which we see today as berms, beaches, and dunes.

The current patterns sort out the **heavy mineral sands**, which become a **renewable resource** unlike other minerals of economic potential. Therefore the mining of mineral sands needs proper planning and removal of only the **replenishment** in most such deposits.

The red clay deposits of the Quaternary Age are found in some areas which overlie the basement rocks. These are believed to have been deposited by old river courses especially the Mahaweli, which is known to have changed its course during the Quaternary times. These red clay deposits are normally 1.00m to 2.00m in thickness, below which lie the former river sands.

Inland and coastal sands are again Quaternary deposits such as wind blown sands and dune sands. These are important resources for the construction industry. Most sand deposits in the inland and coastal areas of NECCDEP provide excellent overburden aquifers with a shallow water table. These will be important potable **groundwater resources**. These aquifers are recharged mainly by the monsoonal rainfall.

Further development is viable for the requirement of the NECCDEP community, on potable water, and to irrigate cash crops via agro-wells.

SECTION 5: DEMAND FOR MINERALS OF THE EASTERN PROVINCE

5.1 Demands for Minerals of the Eastern Province

The demand for minerals occurring in the Eastern province is not confined to the province itself; there is a demand outside the province as well for industry. Where mineral sands are concerned on a major beneficiation, the only operational plant is at Pulmuddai in Sri Lanka. This site was examined during the field survey in detail. The consultant General Manager Mr. S. Nandadewa kindly provided the team with technical operational activities, including the demand for the separated minerals. All other minerals/rock resources will be addressed in the subsequent chapters. Mineral sands in particular will need to be addressed on beneficiation of the beach sand deposits on value addition. Of the 12 minerals/rock resources listed above, there will be a demand outside the province also. It is therefore necessary to give a summary for each mineral in general, which are listed in Annexes I, II and III.

5.2 Description of Mining Methodology

5.2.1 Mineral Sand

Beach minerals are the mineral particles which are deposited on the beach by wave action and currents. The mineral sand as the name implies the sand that contains minerals, are mainly available at the tidal zone of the beach. In our survey it was found that mineral sand is available in number of beach areas along the coastal zone of the eastern province.

The mining of the mineral sand should be planned in a systematic way as the beach is a sensitive area in regard to environmental and social aspects. Generally significant bio diversity exists at the beach and is time sensitive to the environment. As a social factor, sometimes the fishing community may be affected directly or indirectly due to beach sand mining.

It is proposed to mine the beach sand by the striping method manually using hand tools such as shovels, wooden planks etc. Complete omission of mechanized methods is strongly recommended due to potential damages to the environment with severe erosion at the shore and contamination by effluents like blasting emissions and oil.

The mining of beach mineral sand is proposed to be carried out by dividing the littoral land into a number of blocks, and alternative blocks should be mined one after another, in a systematic manner.

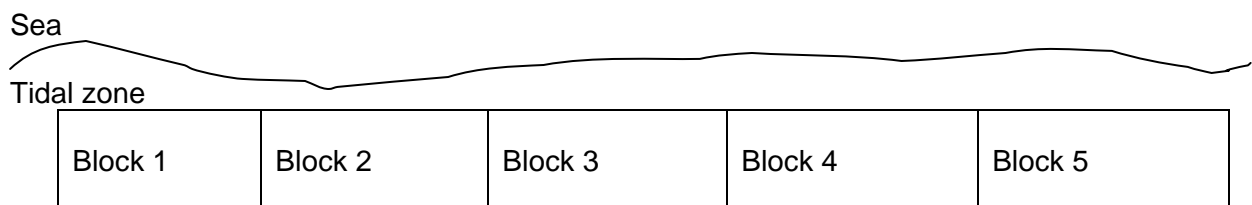


Figure 3: Arrangement of the proposed mining sequence

Figure 3 shows the arrangement of the proposed mining sequence. Extraction of sand should be done in the order of block no.1, no.3 and no.2. Activities in block no.3 can be commenced after the completion of the extraction in the block no.1. While block no.3 is under extraction refilling of block no.1 should be done with the sand taken from the same block after the separation of minerals. If the mining is going to be carried out in a dune area,

replanting of local species of plant is necessary after refilling the area with sand to the initial shape of the particular dune.

Most of the smaller mineral sand deposits that were visited indicate that only surface scraping is viable to recover the heavy mineral products. Such scraping recovery along the areas of high tide deposits and restricted berms can be possible perhaps to a depth of 0.3m, in order to protect the littoral environment.

5.2.2 Clay

Mining of clay, whether it be ball clay, china clay or tile clay should be done with care as the removal of the clay may cause a major change in the ground. This may due to the replacing material for refill, always soil, which differs from the properties of clay material.

Generally, the clay layer exists under an overburden cover of various thicknesses. Therefore the overburden should be removed carefully and maintained for purposes of replacing after refilling is completed. The underlying layer of the clay should be identified and the depth of mining thus determined to avoid contamination.

Mechanized equipment can be deployed for clay mining activities with the consent of the relevant authorities.

5.2.3 Gravel

Gravel falls under building material, used for road construction and land reclamation purposes. Gravel excavation is usually done with mechanized equipments i.e. excavators. While excavating gravel a bench system should be maintained with the prescribed slope angle in order to avoid possible landslides. It is necessary to maintain a buffer zone at the boundaries of gravel excavation sites to safe guard the adjacent lands. As mentioned in the clay mining section above the top layer of soil should be replaced at possible areas to facilitate the growth of local vegetation.

It was noted that in several locations where the gravel was already excavated unsystematic mining has been carried out. In some locations steep angle benches remain with the potential danger of land slides and ad hoc mining excavations could cause serious soil erosion.

The Plate 1 shows an unsystematic gravel pit with a vertical cut slope that may not be stable especially in the rainy season. The free boulders in the forefront of the picture may cause severe damage during a slope failure.



Plate 1: Gravel pit with vertical cut and the abandoned boulders in the site at Palamunai, Batticaloa

5.2.4 River Sand

Extraction of sand is restricted to manual methods in Sri Lanka to safeguard the environment of a river and the surroundings. Cane baskets are highly recommended to collect sand available in the river bed, by dovers. At the sand mining sites special attention should be given to protect the river bank to avoid erosion which can cause severe damage to the riverbank and riverside vegetation.

To protect the river and the river bank from the effect of sand mining the following **guidelines** shall be adhered to.

- Access path down to the river should not be wider than 1m at any instance
- A buffer zone shall be maintained from the riverbank without mining of sand
- Riverbank shall be stabilized by planting riverine species
- Riverbed shall not be dug other than for collecting deposited sand from the top bed

In addition to that, special care should be taken on the incorporated structures with the river such as bridges, pump stations, weirs since sand mining may cause an impact on them.

5.2.5 Boulders, Sized Rock and Aggregates

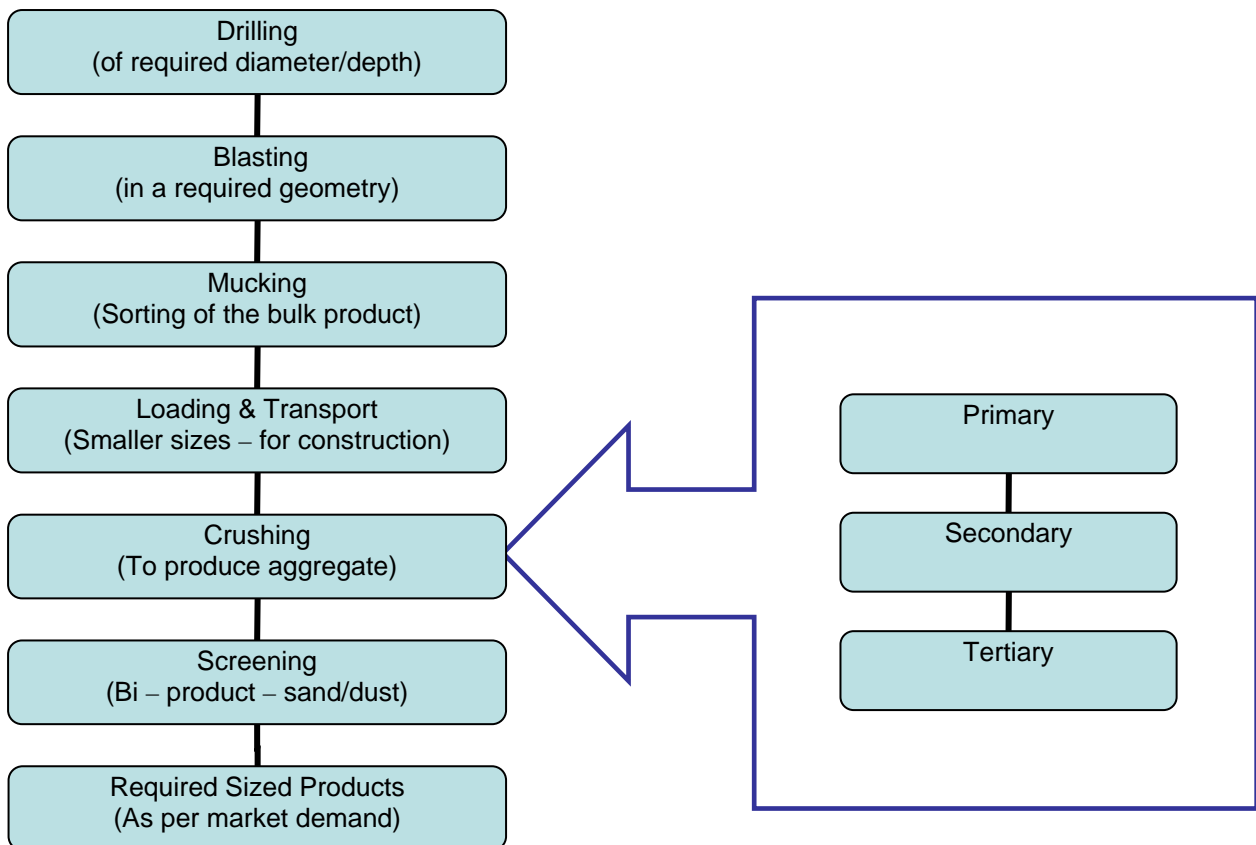
Aggregates are produced by blasting the rock and crushing the blasted material in a crusher plant. Blasting can be done with commercial explosives under the approvals of the relevant authorities. A quarry is the place where the rock is blasted to produce the fragments which can be transferred to a crusher plant. While selecting a location for the quarry site it is preferred that it be isolated from the human activity and not subject to any other important features. The crusher plant can be installed at the quarry site or away from the quarry site. The products of a quarry will include Armour rock (for offshore structures), Boulders (for Groynes and Revetments), all products of importance including quarry sand / dust.

a. Mining schedule and development

- i. Preparation of roadways to reach initial mining points at the center of the site. A bulldozer and an excavator will be employed for this purpose.
- ii. Removal of overburden if it exists, which consists of loose residual soil and rock boulders up to a certain depth will be carried out by an excavator and will be dumped at the vicinity of the site to spread over the same area after mining operations are completed. The removal work will be limited to the immediate mining areas and will be extended to other areas with the development of the mine.
- iii. Removal of the weathered rock layer, if available in considerable thickness, together with associated rock boulders beneath overburden, with an excavator or by means of blasting if necessary.
- iv. Preparation of access roads will facilitate the movement of men and machinery to the rock surface and/or to the benches for various quarry operations i.e. drilling and material handling etc.
- v. Construction of culverts drains and silt traps etc. in order to facilitate an efficient drainage of run-off water as well as the prevention of water pollution by silt and other particulate matter.

- vi. The site will be developed as an open cast mine with a number of benches in order to carryout systematic mining and to provide a safe environment to the workers, and the surrounding community.
- vii. In the blasting of a rock face (eg: License of IML – A) it is important that the blasting geometry is designed by a blasting specialist. This is to ensure a maximum production on a single operation, without any environmental hazards such as “fly rock”.

b. Mining and Processing of Metal



5.2.6 Land based sand

Availability of land based sand was recorded in some locations within the study areas. Plans for mining of the land based sand should have a rehabilitation programme since the mining of sand will leave pits at the site. Therefore refilling the pits is an essential task in a rehabilitation programme before the reclamation of the land. Mined out pits with stagnated water are unsafe for the animals. The Plate 2 depicts an artificial pond created due to ad hoc mining of land based sand.



Plate 2: Water stagnates at the sand mine pit

It is recommended that the relevant Authorities identify and control such abandoned pits and initiate a rehabilitation programme with the supervision of the relevant state agencies.

A glass sand deposit was identified at Thalamkuda area in the Batticaloa district which is also a land based sand deposit. If any mining activities are envisaged in the future it should be incorporated with a rehabilitation programme.

In the NECCDEP area of study, such deposits mainly occur as dunes, and berms within the coastal micro morphology. Within the coast conservation Department (CCD) their clearance will be necessary for such mining, along with a license by the GSMB.

SECTION 6: SUMMARY OF MINERAL OCCURRENCES IN THE THREE PROVINCES

6.1 Beach Mineral Sand

The largest and most important beach sand deposit occurs at Pulmuddai in the eastern coast approximately 54km North of Trincomalee (**Figure 4**) the deposit forms the present beach between high and low tides and extends inland as an older raised beach.

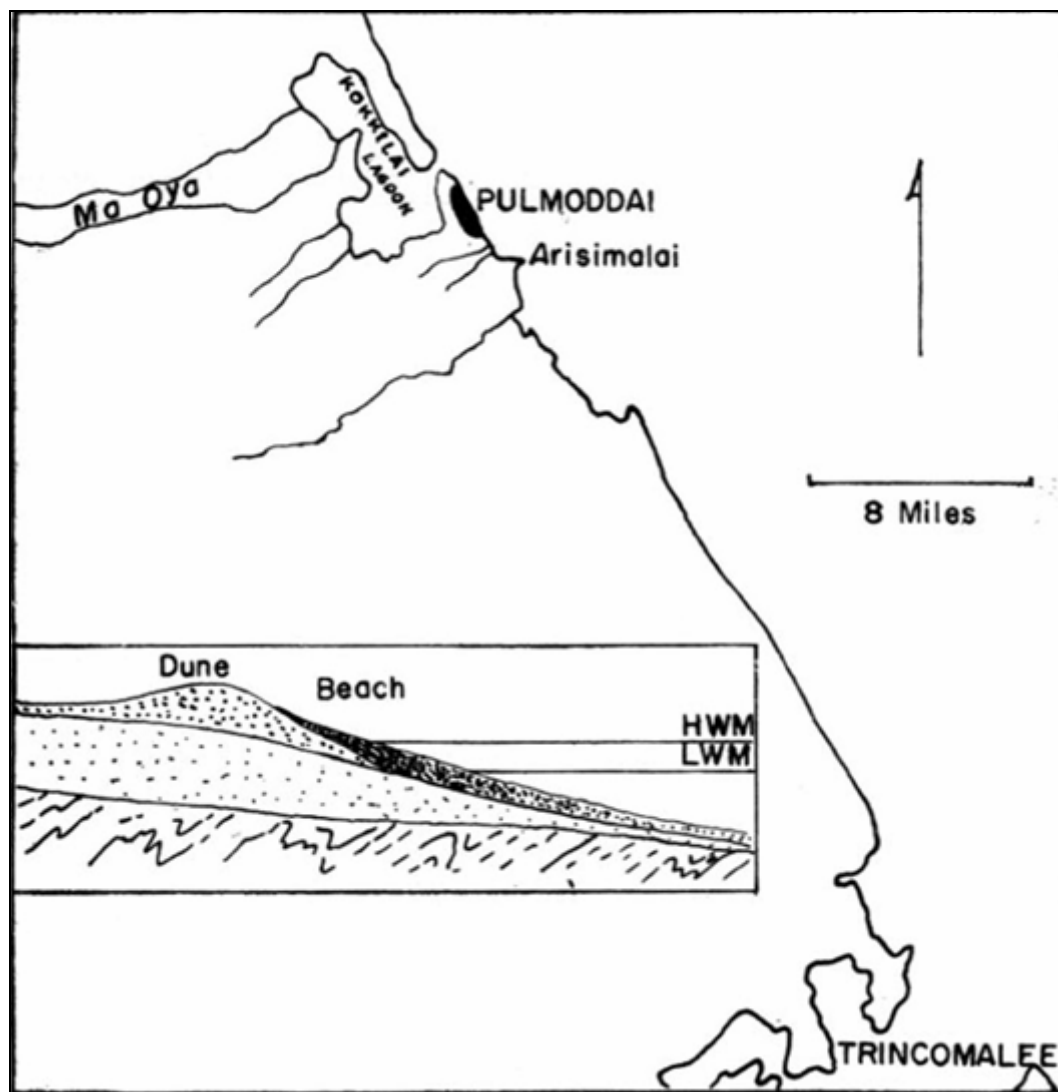


Figure 4: Sketch map of ilmenite deposits at Pulmuddai. *Inset:* Diagrammatic section showing occurrence of ilmenite in beach and dune sands (Cooray, 1984)

The deposit is now worked on by Lanka Mineral Sands Limited, which was earlier Ceylon Mineral Sands Corporation, which commenced commercial production of Ilmenite in 1963. The earlier deposit they worked on was approximately 6.5 km in length, with a breadth of about 60 meters. The approximate composition of the deposit is as follows:

Ilmenite ($\text{FeO} \cdot \text{TiO}_2$)	70 – 75%
Rutile (TiO_2)	10 – 12%
Zircon (ZrSiO_4)	6 – 8 %
Magnetite (Fe_3O_4)	2 – 3%

The balance comprises of quartz sand, garnet, monazite and Sillimanite. The TiO² content of the ilmenite at Pulmuddai is about 52 – 53% which makes it one of the best deposits in the world (P.G. Cooray, 19984).

A lesser known deposit, but similar, occurs at Thirukkivil, which was estimated to have 50% Ilmenite some years ago. In between these two deposits are smaller black sand deposits. These are recorded in **Annexes I, II, and III**. A summary is given below for the 03 annexes (**Table 2**).

Table 2: Distribution and Status of Mineral Sands

Status and mining method	Trincomalee District	Batticaloa District	Ampara District	TOTAL
Existing Mining by SLMSL	4	-	-	4
Economically potential (as a high grade)	-	-	3	3
Potential for scraping (about 0.3m annually)	7	2	8	17
TOTAL	11	2	11	24

Source: Field Observation, 2010

6.1.1 The Pulmuddai Deposit

This mineral sand deposit was worked on under a state-sponsored body established in 1957, named the Ceylon Mineral Sands Corporation which is now known as “Sri Lanka Mineral Sands Ltd” (SLMSL). According to the **SRI LANKA MINERALS YEAR BOOK – 2009**, published by the GSMB, the production of separated mineral sand fractions (**Table 3**), are recorded along with local sales, exports and the income generated (**Table 4 and Table 5**). Please refer Annex VIII for Production and market of the other mining production.

Table 3: Production of Minerals (Tones)

Commodity	2007	2008
Ilmenite	70,728	56,824
Rutile	4,607	3,405
Zircon	381	1,447

Source: Sri Lanka Minerals Year Book – 2009

Table 4: Local Sales of Mineral Sands (Tones, Rs. Thousands)

Commodity	2005		2006		2007		2008	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
Ilmemte	-	-	3	33.10	0.06	0.48	1 940	1 874.76
Rutile	3	222.72	0	1.60	1	65.90	2	63.00
Zircon	0.3	23.42	0	2.60	0.3	24.20	6	3.95

Source: Lanka Mineral Sands Ltd.

Table 5: Export of Mineral Sands (Tones)

Rutile			
Year	Country	Qty.	Value (\$)
2005	Australia	220	125 800.00
	China	6338	1 924 790.00
	U.K.	260	135 720.00
	India	636	355 564.00
	Indonesia	200	103 400.00
	Italy	108	105 840.00
	Malaysia	20	10 440.00
	Netherlands	160	83 520.00

	Philippines	40	20 880.00
	Russia	180	93 960.00
2006	China	1720	409 600.00
	Honking	540	137 700.00
2007	China	1080	346 977.00
	India	3876	2204 762.00
	Israel	77	68 010.00
	Tunisia	75	38 633.00
2008	China	8612	2 838 452.00
	India	2369	1 324 338.00
	Palestine	25	16 000.00
	Tunisia	275	141 653.00
	UAE	54	25 380.00
Ilmenite			
2005	Austria China	25500.0	1 555 550.00
	Kenya	10678.0	438 536.00
	Pakistan	40	5 200.00
	Philippine	75	9 750.00
		10	720.00
2006	Armenia	300.0	12 300.00
	Austria	45775.0	2 952 324.00
	China	9892.0	600 050.00
	India	1041.7	42 709.70
	Pakistan	25.0	1 625.00
2007	Austria	75700.0	4 803 839.00
	China	22025.0	1 361 045.00
	India	551.0	60 998.00
	UAE	20836.00	1 302 231.00
	USA	2700.00	168 700.00
2008	China	15876	939 086.00
	India	5783	308 245.00
	Japan	500	26 000.00
Zircon			
2005	China	22666.0	12 182 511.00
	India	333.0	229 412.00
	Italy	588.0	507 180.00
2006	China	6944.0	4 119 200.00
	Italy	1350.0	1 203 120.00
	USA	27.0	22 950.00
2007	China	9396.0	3 484 517.00
	India	849.0	595 496.00
	Italy	891.0	705 510.00
2008	China	2546	2 295 153.00
	India	1152	752 410.00
	Italy	1836	982 395.00
	UAE	108	74 250.00

Source: Sri Lanka Minerals Year Book – 2009

In order to evaluate the present status of mining management at present and further exploitation, the consultancy team visited the site at Pulmuddai, and held a meeting with the present consultancy/General Manager on site. It was possible to obtain important information on site, which is recorded below.

Meeting with the General Manager

The summary of this discussion held on 30th January 2010 is given in brief below;

1. A few years ago some negotiations were made with foreign countries in order to add value to separated sands. This did not materialize, with the intervention of the Ministry of Industries.
2. In 1983 there was an expansion of the processing plant for value addition, where 150 MT of Ilmenite was earmarked for conversion to **Synthetic Rutile**. However there is a limit of up to 120 MT for this product from the Worldwide Plants. However, to undertake 125 MT of Ilmenite for this, will be risk free.
3. An estimate for the Pulmuddai plant will be a production of 12.5 million Tons of all heavy minerals (mainly Ilmenite, Rutile, and Zircon).
4. The machinery of the separation plant was repaired in 2005, when machinery was being upgraded from 1996 to 2005.
5. From 1994 there was no fresh water supply for the separation plant. The Yan Oya supply was suspended due to LTTE activity. As a result there was no production of Zircon and Monazite. Ilmenite could be separated using sea water.
6. There is an accumulation of unprocessed Zircon perhaps from 1994. As a result there is a space problem at the plant site, where crude Zircon gets accumulated.
7. There is a price however for crude Zircon, where the net profit can be the same, when it is processed as a pure concentrate.
8. It is suggested that smaller deposits along the coast can be upgraded. Such **Upgrading Plants** for concentration will require only **initial screening**, for Separation of the **heavy mineral concentrates**.
9. For example, if 100 MT is upgraded an expected product will have –

Ilmenite	-	60-%
Rutile	-	8 – 10-%
Zircon	-	10%
10. The above product can be delivered to a **Central Plant** for enhanced beneficiation.
11. The primary separation plant at Pulmuddai removes shells, gravel, silica sand, and other detritus.
12. There have been no ships visiting Pulmuddai during the past few years. Therefore it is advisable to transport the products to the Colombo Harbour, or any other selected harbour for shipment.
13. A major bi-product of processing is silica sand, which occurs as man-made low dunes in close proximity to the plant.
14. These sands were given free earlier as construction sand. It has now been stopped due to administrative problems.
15. On a recent visit it was observed that state lands (crown land) of SLMSL had been encroached, for coconut cultivation. It is noted that such lands will be safer after mining of sands where Monazite (a radioactive mineral) is removed from the mineral sands.

6.1.2 Comments – For Decision Makers (Guidelines)

- a) On the field visit it was noted that there was no systematic mining along the beach front. Ad hoc locations were in operation. Therefore a plan for mining in an organized manner should be implemented.
- b) It is **highly recommended** to have small **upgrading plants** for the smaller deposits of heavy mineral sands for upgrading the concentrates.
- c) Such upgraded products should be supplied to the **Central Plant**, for the final Beneficiation, in an organized manner.
- d) For exports, a harbour for delivery of mineral sand products should be decided. In the past, barges collected the product by conveyor belts at the Pulmuddai Pier, for delivery to ships off-shore. This **may not be cost effective**.
- e) The man-made dunes near the plant, which is of silica sand, needs to be eliminated, for space obstruction.
- f) The above silica sands are rain washed by monsoons over the years. A few million M.T can be estimated for disposal. Such sands will have minimal salinity (NaCl), and therefore suitable for construction sand. A **price can be fixed** by the decision makers for this disposal.

6.2 Construction Sands (River & Dune Sands)

During the field visits undertaken the economically viable deposits were identified separately for all three districts separately. These are provided in detail in **Annexes I, II, and III**. A summary is given below (**Table 6**) for the 03 annexes, for construction sands available.

Table 6: Distribution and Status of Construction Sands

Status and mining method	Trincomalee District	Batticaloa District	Ampara District	TOTAL
Stockpile (only at Pulmuddai)	1	-	-	1
Existing (mining in progress)	5	4	2	11
Potential use as resources	1	1	5	7
Abandoned	1			1
Total	8	5	7	20

Source: Field Observation, 2010

A number of locations were identified, where river sand is mined. Some locations did have mining licenses from GSMB, while others were illegal. This can be regarded as an important resource, especially when considering a future potential boom in the construction industry, for its demand. Of the three districts a major resource potential can be identified for the Trincomalee District, in the area of the mouth of the Mahaweli Ganga. It is important that all mining groups obtain licenses from the GSMB, with stipulated regulations, where environmental considerations are taken into account.

Also a number of locations were identified, where economically viable **dune sands** exist. Most of these are windblown sands, in close proximity to the coast. In general these are fine grained sands with low organic content. Most significantly these dunes over the years had

been leached of salinity by monsoonal rains, and therefore are suitable for the construction industry. Some deposits have village habitations with fencing, and as to whether these are legal or not, **within the coast conservation Department (CCD)** reservation. Especially when such dunes are prominently **above the general flat terrain**, mining can be possible with licenses from the GSMB, which can be obtained, with environmental restrictions.

6.3 Manufactured Constructions Sands

Especially in China, due to its demand for sands, on its rapid construction activities, Quartzites, and other high quartzitic rock is used to manufacture sand. This is when traditional river sand resources get depleted. Such plants for manufactured sands had been installed in China during the past two decades.

Similar plants for Sri Lanka were introduced by mainly Chinese entrepreneurs, with SL collaboration, during the past few years. It is unfortunate that none of these projects took off the ground, due to various technical/bureaucratic reasons. In Sri Lanka the main raw material for manufactured sand will be Quartzite, which occurs as elevated ridges especially in the Trincomalee district.

At present the only manufactured sand is a bi-product from crushing plants. The bi-product is both quarry sand, and quarry dust, when crushing crystalline hard rock for different sizes for the construction industry.

Quartzite ridge; weathered overburden materials of a quartzite ridge have already been mined to get gravel for road surfacing of the Iluppadichenai - Toppigala road. GPS point is taken at the crossing point of quartzite ridge (284311E, and 280002N). Currently, only quartzite rock is available at this location and it is extended for a few hundred metres in length, nearly 40m wide and 7 – 10m high strike ridge structure. The entire ridge is situated in an isolated location; No human settlements are observed at the vicinity of this quartzite ridge structure and it is covered by paddy fields; it is possible to use quartzite rock materials of this ridge structure for the preparation of manufactured sand by crushing.

6.4 Glass Sand

Only a single occurrence of white glass sand is recorded in the Ampara district (Annex III) in the area of Manalchena. The deposit covers a few acres.

The quality glass sand is suitable for both glass and ceramic industries as a raw material. This can be in demand for the newly **expanded Ceylon Glass Co Ltd factory at Horana with Indian Collaboration**, within the Industrial Estate. The resources on quantification will have to be assessed for a local glass industry, if viable.

For the local ceramic industries this quality glass sand can be used for ceramic body mixtures, and for the manufacture of glazes. However preliminary analysis of samples will be necessary for quality confirmation tests. For mining GSMB licenses will be required.

6.5 Metal Quarries (Working and abandoned)

A large number of both working and abandoned quarries exist in the study area of the Eastern Province. In addition un-worked rock outcrops of potential exist. The following records were made during the field visits undertaken to the 03 districts. They are given in Annexes I, II and III. A summary is given below (**Table 7**) for the 03 annexes.

Table 7: Distribution and Status of Metal Quarries

Quarry Type	Trincomalee Dist. Annex - I	Batticaloa Dist. Annex - II	Ampara Dist Annex - III	TOTAL
Working (Existing Reserves)	05 Nos	02 Nos.	04 Nos	11
Abandoned (Rock available)	03 Nos.	01 No.	05 Nos	09
Potential For future	04 Nos	01 No.	00	05
Total	12	04	09	25

Source: Field Observation, 2010

The above table indicates that in the study area of NECCDEP there are a total of 25 quarry sites of the 03 categories given in the table above. It is important and significant to recognize the following

- There are **11 Existing/Working** quarries with available rock resources for expansion.
- There are **09 abandoned quarries**. This had been mainly due to the conflict situation with the LTTE.
- There are **05 potential quarry** sites for development.

6.5.1 Accepted Rock Types

The tabulation of **Annexes I, II, and III**, are for accepted rock types, such as Charnockites, Biotite/Hornblende Gneisses, and Granitic Gneisses. These rock types are of significant demand for **highway construction, harbour developments, and building construction** for the Eastern Province. The quarry of charnockitic gneiss and Piyangala Quarry (Ampara District) is supplying all rock resources for the construction of the Oluvil Harbour. The Eastern Province NECCDEP area has a number of existing fishery harbours, earmarked for expansion, and **additional fishery harbours are on plan**. These will require quality rock resources such as Armour Rock/ Boulders/Rock aggregate for the construction of beakwaters/Rivertments/ Groynes and for associated infrastructure.

In addition to this, under the Government concept – “Mahinda Chintanaya – Phase II” the eastern province is of priority for development which will include:

- Development of Highways/Bridges/Retaining structures
- Infrastructure Complexes/Buildings
- Fishery Harbours

All the above activities will require a few million cubic meters of quality rock, which is available within the NECCDEP study area. Therefore this is a priority concept for decision makers.

6.5.2 Comments for decision makers (Guidelines)

- a) On the field visits undertaken to all sites, it was observed that rock resources are hardly exploited to its available potential.
- b) A definite employment generation is seen here, for quarry development, and supplies for the NECCDEP Community of target.
- c) To establish Central Crushing Plants to provide rock aggregates as per market demand,
- d) It is possible to supply these resources outside the Eastern Province for development projects, provided that authorities arrange a marketing system.

6.6 Gravel Resources (Mainly Quartzitic & Pegmatitic or weathered rock gravel)

These resources are available in all 03 districts of the province, which are provided in Annexes I, II and III. Gravel is an important commodity for national development activities especially in the following usages. Distribution and Status of Gravel Resources are given in Table 8.

- Material for land fill and reclamation
- For poor soil replacement, with compaction – for a foundation base
- A sub-base for highway construction
- A founding base for multi story building pad footings

Table 8: Distribution and Status of Gravel Resources

Burrow Status	Trincomalee Dist. Annex - I	Batticaloa Dist. Annex - II	Ampara Dist. Annex - III	TOTAL
Operational (sometimes partially)	07 Nos	01No	02 Nos	10
Abandoned For most resources	02 Nos.	03Nos.	06 Nos	11
TOTAL	09	04	08	21

Source: Field Observation, 2010

In this scenario gravel will be an important commodity for the national development of the **Eastern Province and also outside its boundaries**. In this evaluation only the NECCDEP area is in focus. The table below is a summary of the Annexes.

From the above table it is evident that 21 resource areas were identified, where GPS readings are provided in the Annexes. The burrow status of the above table reflects **mainly partially excavated resources**, where resources still exist. The excavations are not rehabilitated to restore the existing ground level. **Details are provided** in annexes I, II and III, with relevant details and recommendation. Some gravel excavations (mainly a by Back – Hoe) cannot be rehabilitated without a massive financial outlay.

A **typical option** in the above scenario is recorded in Annex – I for the Trincomalee District where a vast acreage is excavated down to 3-4m below the existing ground level. Here it is possible to convert this vast area to a **tank for breeding fresh water fish** species. If these stagnant water bodies remain, at site, it will be a hazard for the local communities' safety, and will of course promote a mosquito breeding environment, along with other health hazards.

Geologically these gravel deposits exist due to weathering of quartzitic country rocks, quartzites and pegmatites. This is a **non-renewable resource**. Therefore there should be an overall plan for the Eastern Province for this resource, both for excavation rehabilitation, and to maintain future resources.

6.6.1 Comments for decision makers

- a) On field visits undertaken to the 03 districts most such gravel resources exist below the existing ground level, except for about 5 – 6 locations in the Trincomalee District, (between Trincomalee and Nilaweli) which is quartzitic gravel elevated above ground level. No environmental problems are envisaged for mining these resources, after excavation to ground level.
- b) Most other areas of the Province have locations where excavations by burrow, below the existing ground level will pose environmental problems, without any Rehabilitation Plans. As recorded above under Para 6.6 there should be an overall plan for such ad-hoc excavations.
- c) Excavation of gravel by back-hoe or excavators is economical, rather than manual labour.

- d) This is an important resource to market, within the Eastern Province and outside for National Development Projects.

6.7 Brick (Tile) Clay

Brick and Tile clay resources which occur in the Trincomalee and Batticaloa districts are given in **Annexes I, and II**. In the Ampara district the clay deposit close to Ampara town is not within the NECCDEP area, and therefore not discussed in this report, which has a tile factory – formerly under the Ceylon Ceramics Corporation.

Significant clay deposits were recorded during the field visits to the district of Trincomalee and Batticaloa, which are provided in annexes I, and II. A summary is provided in **Table 9** below.

Table 9: Distribution and Status of Clay resources Gravel Resources

Status of Clay Deposit	Trincomalee district Annex – 1	Batticaloa District Annex - II
Working (With Existing Resources)	02	00
Partially mined (with existing Resources)	00	01
Total	02	01

Source: Field Observation, 2010

Although there only 03 deposits of clay within the two districts, resources still exist after partial excavation for clay by manual methods. These are at present mined **for only the manufacture of bricks**. Yet the quality indicates that the clay will be also suitable for the manufacture of tiles and pottery. Especially in **Mangalapura** of the Trincomalee district about **100 families** are engaged in the mining of clay, and the manufacture of bricks, in an area of **100 to 200 acres** of land. Vast resources still exist, and mining is not planned. Ad hoc mining in crown land operates without GSMB Licenses. These deposits have a thickness of 1.00m to 1.5m. This mining needs to be regularized, by the authorities concerned. Most such lands are crown lands (e.g.: under the Forest Department).

6.7.1 Comments for decision makers (Guidelines)

- Mining for clay resources requires a license from GSMB. This is not operational now, where as unplanned mining exists in crown lands.
- A few hundred families depend on clay mining/manufacture of bricks without any regulation/permits. This is a **social obligation** for the authorities concerned.
- In the clay beds mined there is **no rehabilitation** by way of filling. Stagnant water is both an **environmental and a health** hazard for the community.
- These clay beds will be an important resource for the NECCDEP community, for self employment, and **sustenance**.
- Perhaps, if mined systematically the resources could be marketed for Tile factories outside the NECCDEP area.

6.8 Potable Ground Water

Potable ground water will be an **important commodity especially for the coastal sector** of the NECCDEP area of the Eastern Province. This is because of the salinization of coastal sand aquifers, when we consider a **rise in sea levels in the future**. Also due to excess community habitation near the coast (e.g.: fishing folk), the fresh water sand aquifers are subject to **pollution**, due to human activity. Therefore fresh/potable water will be a vital commodity for the future, along with **protection**.

Therefore our Team of consultants decided to address this issue on a **priority basis**. During the field surveys excellent and functional sand aquifers were observed in the Trincomalee District, and Batticaloa as given with details in **Annexes I and II**. These can be considered as valuable fresh water resources. Such resources can be considered for a village level water supply scheme, if properly implemented. Also irrigation of cash crops is possible via **agrowells**, some of which are already operational. A summary of important locations are provided in **Table 10** below:

Table 10: Distribution and Status of Potable Ground Waters

Hydrogeological Potential	Trincomalee District Annex- I	Batticaloa District Annex II	Ampara District Annex III
Very promising Aquifer – In Sands.	Kuchchveli – Both sides of the main road – sand aquifer – three dug wells pumped to 200 houses	Thalamkudah Community Wells Kirankulam Community Wells for agriculture. Kaluthavalai sand aquifer for agriculture	White sand occurrences suitable for manufacturing of glass products are occurred in Manalchena area. These white sand occurrences are extended for few acres in extent.
Highly potential shell conglomerate aquifer	Kumburupitti village (N of Trinco), for 1Km distance on both sides of main road - Agro wells for cultivation.		

Source: Field Observation, 2010

The details are provided in Annexes I, and II. These are aquifers of high potential for the NECCDEP community, both for drinking and community cash crop agriculture.

6.8.1 Comments for decision makers (Guidelines)

- a) As a vital commodity for community of the NECCDEP sector these resources must be protected without pollution by human activity (e.g.: household dug wells).
- b) Village level **water supply projects** can be promoted from these shallow seated water resources (1.00m to 1.5m water table). This is very economical pumping.
- c) Large diameter **agro wells** are viable in these aquifers for the cultivation of cash crops for the community, for an enhanced income.
- d) These fresh water aquifers today are free of salinity. Protection of these aquifers, **without pollution can be considered as priority** of the Authorities concerned.

6.9 Thermal Water (Hot Water Springs)

Within the NECCDEP study area hot water springs occur only in the Trincomalee District at Kanniya near the Trincomalee town. There are five wells adjacent to each other, which are hot water springs confined by concrete aprons.

Some geologists believe that the thermal water is due to magmatic activity of the crust in close proximity to the existing ground level. Others believe that here the issue of thermal water is believed to be via deep seated rock fractures. This is substantiated by emanating gases from the water, mainly hydrogen sulphide (H₂S), easily identified by smell. The five wells have slight variation in temperature, and the average temperature can be taken as 42° C.

The thermal water is said to have therapeutic value, especially for skin conditions, which may be attributed to the dissolved sulphur from the gaseous fractions of sulphur Dioxide (SO₂) and H₂S. For this reason and for the hot water a number of local tourists visit these wells for bathing.

Some Electrical Resistivity Surveys (ERS) have been carried out in the area of the hot springs, especially by the physics Department of the Open University. These have indicated deep seated fractures and rock type variations. Also geological surveys with maps are available. However this data is insufficient to evaluate potential Geothermal Energy.

Detailed investigations will be necessary to understand the possible use of deep seated hot water for power generation. It will be necessary to drill deep boreholes in to the basement rock to intersect identified fractures, with temperature measurements with depth. Utilization of hot dry rock geothermal energy is another concept, which needs detailed investigations.

This site has a definite tourist potential which can be developed by the Kanniya Pradeshiya Sabha for hot water bathing and Spa as tourist attractions for a resort.

6.10 Salterns Existing/abandoned/Proposed

As given in **Annex – 1** salt resource (NaCl) are available in the Trincomalee District.

Existing/working salterns are at Munaichenai, and Kachcakoditivu details of which are given in Annex – 1.

A saltern can be proposed in the area of Periyakarachchi in an 1800 acre area in the lagoon. The saltern at Nilaweli has been abandoned, which remain so from 1980's. This is a potential site to recommence the industry. A vital focus for decision makers. **Guidelines** for this project will require a feasibility study, along with the economical viability for the NECCDEP community.

6.11 Shell Beds for lime manufacture

At present shell beds are mined to manufacture lime only in the Batticaloa District. At Navaladi in the Batticaloa lagoon shells are collected by hand picking. The burning of shells is carried out as a **cottage industry**.

Similarly in the Arayampathy area shells are mined from Muhathuwaram in the Batticaloa lagoon as a cottage industry.

The above GPS locations are provided in **Annex II**.

6.12 Copper – Magnetic Deposit at Seruwila

The Copper- magnetite deposit at Seruwila was discovered by the GSMB (formerly Geological Survey Department) in 1972. An extensive exploration programme, including detailed geological mapping, ground magnetic survey and core drilling was conducted in mid and late seventies. It occurs as a series of lenticular pods arranged along the regional strike and is spread over an area of nearly 10 square kilometers. Its mineralization, mainly magnetite and copper minerals – chalcopyrite, bornite, malachite and azurite, etc) is restricted to basic metamorphic rocks. It occurs in three discrete blocks, namely, Arippe, Block – B and Kollankulam Blocks. The ore can be divided into two sub-groups based upon the texture and mineralogy.

1. Massive ore (massive magnetite with little copper minerals and little or no host rock.)
2. Disseminated ore (copper minerals and magnetite disseminated in the host rock and the ore is particularly rich in sulphides.)

Results of the exploration programme revealed that a total of 4.5 million tones of reserves occur in the entire deposit with an average grade of 1.5% of Cu and 38 – 39 % of soluble Fe. It has been suggested that the mineralization is along a deep seated thrust at the contact of the Highland Complex and Vijayan Series.

It occurs as a series of lenticular pods, arranged along the regional strike, and is spread over an area of nearly 10 square Kilometers.

It is suggested the possibility of mining the ore for a **smelting plant** to extract iron and copper, possibly with foreign collaboration, as an industry for the Trincomalee District is explored. The mining will be mainly below the existing ground for the recovery of lenticular pods, which is similar to mining of graphite (Plumbago). The economic feasibility for this project will require an economic viability study.

This site was visited by the team to evaluate the present status on Crown Land, occupied by Chena Cultivations. Photographs below show the outcrop/deposit/ore.



Copper Magnetic Deposit at Seruwila

SECTION 7: MINERAL OCCURENCES WITHIN THE PROJECT AREA BY DISTRICTS**7.1 Mineral Occurrences within the NECCDEP Area of Trincomalee District**

Following mineral occurrences were identified within the area covered by the NECCDEP Zone in the Trincomalee District during the rapid field assessment

1. Mineral Sand
2. Construction Sand (River Sand)
3. Construction Sand (Piled Up Sand)
4. Construction Sand (Land Based Sand)
5. Construction Sand (Manufactured Sand)
6. Brick and Tile Clay
7. Ground Water
8. Salterns
9. Gravel Pits
10. Metal Quarries
11. CU – Fe Deposit at Seruwila
12. Hot Water Springs at Kanniya

1. Mineral Sand

In Sri Lanka, the largest mineral sand occurrences are reported from Pulmuddai, in the eastern coast (north of Trincomalee). In the Pulmuddai area, mineral sands are observed in the coastal plain (tidal area, berm area and low dunes) and are extended for nearly 100 – 150m distance in landward direction (Plate – IA). The mineral sands occur along the coast for nearly 5.5km length from Pulmuddai (225210E / 414025N) to South of Kokilai Lagoon (221234E / 419469N).



Plate - IA: Presence of Mineral Sand Occurrences for 100 – 150m distance in the Beach Plain of Pulmuddai

In addition, economically viable mineral sand occurrences are also observed in coastal stretches of Koduwakattu – Kalarawa, Periakachchi, Salapei aru, Kuchchaveli, Palchenai – Verugal and Lankapatuna – Uppural areas in the eastern coast (south of Trincomalee). In the Palchenai – Verugal beach plain, mineral sand occurs as a nearly 50m wide (towards landward direction) and about 3km long body (along the coast in tidal zone and berm area (Plate – IB). In the Koduwakattu area, economically viable mineral sand occurrences are extended for about 700 – 800m distance in landward direction and nearly 6km distance along the coast. In the Lankapatuna – Uppural area, beach sands are extended for 40 – 50m distance in landward direction and about 2.5km distance along the coast (Plate – IC).



Plate – IB: Occurrence of mineral sand along Palchenai – Verugal coastal stretch

Plate – IC: Occurrence of mineral sand along Lankapatuna – Uppural coastal stretch

In addition, garnet rich black mineral sands are mainly concentrated within the berm zone of beach in the Alankerny area along the Kinniya – Muttur road (Plate – ID). In this stretch, mineral sand could be mined by scraping the beach zone up to 0.3m depth.



Plate – ID: Presence of garnet rich mineral sand along the Alankerny beach zone

2. Construction Sand (River Sand)

Vast reserves of river sand occurrences are observed along the river bed of the Mahaweli River. Of these occurrences currently mining sites are located in Bogaspitiya, Kinniyapitiya, and Kotiyapitiya areas in the North of the Siththaru Bridge near Kantale. All these mining activities are conducted by obtaining valid mining licenses from the GSMB (Plate – IIA).



Plate – IIA: Occurrence of sand bar in Mahaweli River bed at Kinniyapitiya

In addition, further towards the northeast of the Mahaweli River bed in the Neelapola area (near Dehiwatta), sand mining activities are conducted within a Wildlife Sanctuary, illegally (Plate – IIB). At this location, large scale sand mining activities are conducted. Mined sands are stockpiled in the flat area outside the wildlife sanctuary (Plate – IIC).



Plate – IIB: Illegal sand mining in Mahaweli River bed at Neelapola area

Plate – IIC: Stockpiled sand outside the wildlife sanctuary

In addition to this, medium scale sand mining activities are conducted in the Wellanaval area in the right bank of the Mahaweli River, within a Wildlife Sanctuary, illegally. Sand mining location could only be reached by a boat and is about 4km away from the sand stockpiling area at Ralkuddi. Mined sand is transported to the Ralkuddi area near the west of Muttur by boats (Plate – IID).



Plate – IID: Mined sand are transported to Ralkuddi area near west of Muttur by boats

River sand mining activities are also conducting on a large scale in the Verugal Aru stream bed and stream banks in the Mawadichenai Area (Plate – IIE). In the right bank of the river, a sharp bend is observed and a large sand bar has formed at this location.



Plate – IIE: Sand mining in Mavadichenai area in Verugal Aru

In addition to this, a number of small to medium scale river sand mining sites exist in a number of other locations in the District.

3. Construction Sand (Piled up Sand at Pulmuddai)

After refining mineral sands in Pulmuddai, remaining sands were piled up for nearly 100m long, 50m wide & 10-12m high and 125m long, 50m wide & 12-14m high two sections within the LMS Ltd premises (Plate – III). These sands could be used for construction activities.



Plate – III: Piled up sand (after refining mineral sand) at Pulmuddai

4. Construction Sand (Land Based Sand)

Paths of a number of river systems in the country, in their matured stages, had been changed over the centuries due to physiographic conditions. Vast amounts of well sorted sand are preserved in these ancient river courses. These sand occurrences have presently been underlain by a few metres of thick clay beds. Field evidence reveals that the ancient river course of the Mahaweli River is lying several kilometers west and east of its present path and a significant concentration of sand beds are preserved in these sections of the old Mahaweli River course. One such preserved sand bed is identified in the Siri Mangalapura area, near Somapura. In this section, about 4-6m thick sand occurrences are encountered, below the 1 – 1.5m thick brick clay bed. Few years back, some outsiders started mining these land based sand occurrences. However, due to the strong opposition of villagers they had to abandon the mining activities. The area is very promising to open up the sand mining industry. However, if sand mining is allowed in this area, it is necessary to rehabilitate the mined pits. The entire area lies in a land belongs to Forest Department.

In some coastal stretches of the study area, land based sand formations (blown sands in the coastal plain) are extended for few hundred metres in landward direction. It was observed that at some places (in Kayankerny area), these sand formations were mined in illegally by road developers. As a result unfilled pits were present in coastal plain, causing environmental impacts to the coastal plain. This type of land based sand mining activities in coastal plain should not be allowed.

5. Construction Sand (Manufactured Sand)

In the area centred on Trincomalee, a large number of 6 – 12m high, 15 – 20m wide and several kilometres long, quartzite bands are observed. In these quartzite rock, reddish brown gravel occurrences in the weathered overburden cover. In several quartzite bands, weathered overburden cover has already been mined to apply on road surfaces during road development work. Hence, only highly fractured quartzite rock exists in these rock bands (Plate – V) and some of these rocks are identified in human settlement free locations. Hence, it is possible to use these rocks for producing manufactured sands.

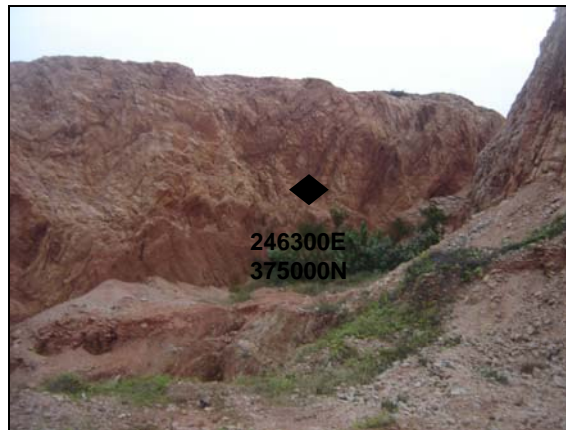


Plate – X: Presence of highly fractured quartzite ridges

Due to over exploitation of river sands, considerable degradation has been caused to the fluvial environment of the river system of the country. Presently it is evident that the removal rate of river sand exceeds 2.7 times of annual transport rate of sands in the rivers. Major environmental hazards encountered in these fluvial environs are due to over exploitation of sand and the consequent impacts are as follows.

1. Excessive river bank erosion and collapsing - this will lead to loss of land, local flooding, damage to adjacent infrastructure, buildings, bridges, etc.
2. Deepening of river bed – this will lead to salt water intrusion, drop of water table thus drying up of adjacent wells, embankment collapses, erosion of catchment areas.
3. Reduction of sediment flow to beaches – this will eventually lead to coastal erosion.

Therefore, by introducing other resources of sand, such as manufactured sand, the above mentioned impacts, causing to the river system, could be controlled, greatly.

6. Brick and Tile Clay

In the Siri Mangalapura area, brick and tile clay occurrences are identified in about 100 – 200 acre land. The entire area appears to be an ancient flood plain (possibly ancient flood plain of Mahaweli River). Its thickness is about 1-1.5m. Below the clay bed sand beds are encountered. Nearly 100 families are engaged in the brick manufacturing industry by mining this clay bed (Plate – VIA). The entire land belongs to the Forest Department.



Plate – VIA: Presence of brick Manufacturing Industry in the area

In addition to this, another large scale brick manufacturing industry is observed in the Punagar village near Echchalampattu.

In this area, brick clay occurrences are identified in about 50 acre land. Its thickness is about 1-5m. Brick manufacturing industry is largely conducting in the area by mining this clay bed (Plate – VIB).



Plate – VIB: Presence of brick manufacturing industry in Echchalamtattu area

7. Ground Water

On both sides of the road around Kuchchaweli town limits, good ground water bearing area exists in sandy aquifer (Plate – VIIA).

Another good ground water bearing area in sandy aquifer is identified in Salapei Aru a Tsunami Village, north of the Kuchchaweli area (Plate – VIIB). The Salapei Aru Tsunami village comprises of 200 house units and within the help of three dug wells; water is pumped to 200 houses.



Plate – VIIA: Ground water is pumped for agricultural purposes in Kuchchaweli area



Plate – VIIB: Ground water is pumped for house units in Kuchchaweli area

8. Salterns

In the Periyakarachchi area in Kuchchaweli, a privately owned saltern is proposed in an 1800acre land within the Kuchchaweli lagoon (Plate – VIIIA). In Addition, an abandoned saltern (abandoned in eighties) is identified in the Nilaweli Lagoon in the Nilaweli North area (Plate – VIIB). This is a potential site to re-commence operations.



Plate – VIII A: Proposed saltern site in Kuchchaweli lagoon
Plate – VIII B: Abandoned saltern in Nilaweli North

In addition, another two privately owned existing seasonal salterns are encountered in the Munaichenai and Kachchakoditivu villages along Kinniya – Thambalagamuwa road. Both these salterns are in operation only during the Yala Season. During the Maha Season, both these salterns cannot be operated due to the flooding nature of both lands during NE monsoon rains.

9. Gravel Excavation

In the area centred on Trincomalee, large number of 6 – 12m high, 15 – 20m wide and several kilometres long, quartzite bands are observed. In these quartzite rock, reddish brown gravel occurrences in the weathered overburden cover. In several quartzite bands, weathered overburden cover is being mined to get gravel materials for use in road development activities (Plate – IX A).



Plate – IX A: Number of existing gravel pits located in dip slope of quartzite ridge

During the field investigations large numbers of abandoned gravel mined pits were encountered in about 200m x 150m size land area in the Illandeikulam village. In this area unsystematic mining was conducted about 2-5m below the ground surface. None of the mined pits were rehabilitated and as a result pits of stagnated water are observed in vast areas (Plate – IX B). This feature is a severe environmental hazard for the area. It is proposed to rehabilitate the mined pits by converting them to a tank and thereby fresh water fish breeding could be done. GPS point is centre point. This type of gravel beds (extend only below the ground surface) should not be allowed to mine in future. It is appeared that mining activities were done by the road developers, illegally,



Plate – IXB: Presence of water stagnated gravel mined pits in Illandeikulam village

10. Metal Quarries

Number of different sized existing and abandoned metal quarries exists within the study area. In addition, number of potential sites, good for opening up of metal quarries was also identified during the survey. These include massive charnockite, charnockitic gneiss, charnockitic biotite gneiss, pink granitic gneiss and hornblende bearing pink granitic gneiss. Of these quarries, some are currently operating after getting mining licenses. On the other way it appeared that most of the abandoned quarries were operated without having a valid mining license.

Of these quarry sites, existing charnockitic gneiss quarry at Mutur is prominent (Plate – X).



Plate – X: Metal quarry at Mutur

11. Cu – Fe Deposit at Seruwila

The Seruwila Cu-Fe body occurs as a series of lenticular pods arranged along the regional strike and is spread over an area of nearly 10 square kilometres. Its mineralization, mainly magnetite and copper minerals – chalcopyrite, bornite, malachite and azurite, etc., is restricted to basic metamorphic rocks. It occurs in three discrete blocks, namely, Arippu, Block – B and Kollankulam Blocks.



Plate – XXII: Cu-Fe Deposit at Seruwila

12. Hot water spring

The hot water springs are located in Kanniya, near Trincomalee; Average temperature of these hot water wells is 42⁰C; Total of five wells are located adjacent to each other; All these hot springs smell characteristic hydrogen sulphide gas and they have been developed by the Kanniya Pradeshiya Sabha for spa / hot water bathing for tourists.

Detailed investigations are needed to check the possibility of use of hot water springs for power generation. Utilization of hot dry rock geothermal energy is another option that needs to be investigated.

7.2 Mineral Occurrences within the NECCDEP Area of Batticaloa District

Following mineral occurrences were identified within the area covered by NECCDEP Zone in Batticaloa District during the rapid field assessment

1. Mineral Sand
2. Construction Sand (River Sand)
3. Construction Sand (Land Based Sand)
4. Construction Sand (Manufactured Sand)
5. Glass Sand
6. Brick and Tile Clay
7. Ground Water
8. Shell Beds
9. Lime Burning Industry
10. Gravel Pits
11. Metal Quarries

1. Mineral Sand

In addition, economically viable mineral sand occurrences are observed in coastal stretch of Marnkerni – Keelikudah in the eastern coast (north of Kalkudah). In this stretch, black sand concentration is rich in both tidal and berm area; Black sands are extended in nearly 40m wide stretch in landward direction (Plate – 1).



Plate – I: Occurrence of mineral sand along Marnkerni – Keelikudah coastal stretch

2. Construction Sand (River Sand)

Vast reserves of river sand occurrences are observed along the river bed of the Maduru Oya near Vakaneri. Existing river sand mining locations in Maduru Oya river bed and flood plain were identified in the Mullivattavan village in Vakaneri. In this location, medium to coarse grained good quality sand bar is encountered in nearly 400m long, 30m wide and 1.5m high section (Plate – IIA).



Plate – IA: Sand occurrences in Maduru Oya RIVER BED

In addition, current, sand mining location is also located in the river bed of Mavadi Odai and its branch stream. The Mavadi Odai branch stream is located about 100m west of Mavadi Odai main stream, along Iluppachchenai - Toppigala road; In both these locations, medium to coarse grained good quality sand is mined from the both river beds and their banks.

Furthermore another existing sand mining location is identified in the Levaru Aru stream in Palamadu area. Considerable amount of sand is mined from the sand bar in the river bed and in both banks. The mined sand is transported to stockpiling area located about 500m away.

3. Construction Sand (Land Based Sand)

In some coastal stretches of the study area, land based sand formations (blown sands in the coastal plain) are extended for few hundred metres in landward direction. So far, sand mining activities from the coastal plain has not been commenced legally or illegally. It is not recommended to conduct any type of sand mining activities in these coastal plain.

4. Construction Sand (Manufactured Sand)

In the Veppavadduvan area (Iluppachchenai - Toppigala road), several hundred metres long, nearly 40m wide and 7 – 10m high quartzite ridge structure is observed. Weathered overburden materials of this quartzite ridge have already been mined to get gravel for road surfacing; Currently, only quartzite rock is available in this ridge The entire ridge is situated in an isolated location; No human settlements are observed at the vicinity of this quartzite ridge structure and it is covered by paddy fields; It is possible to use quartzite rock materials of this ridge structure for preparation of manufactured sand by crushing.



Plate – IV: Quartzite Ridge in Veppavadduvan area

Due to over exploitation of river sands, considerable degradation has been caused to the fluvial environment of the river system of the country. Presently it is evident that the removal rate of river sand exceeds 2.7 times of annual transport rate of sands in the rivers. Major environmental hazards encountered in these fluvial environs due to over exploitation of sand and the consequent impacts are as follows.

1. Excessive river bank erosion and collapsing - this will lead to loss of land, local flooding, damage to adjacent infrastructure, buildings, bridges, etc.
4. Deepening of river bed – this will lead to salt water intrusion, drop of water table thus drying up of adjacent wells, embankment collapses, erosion of catchment areas.
5. Reduction of sediment flow to beaches – this will eventually lead to coastal erosion.

Therefore, by introducing other resources of sand, such as manufactured sand, the above mentioned impacts, causing to the river system, could be controlled, greatly.

5. Glass sand

White sand occurrences which are suitable for manufacture of glass products are identified in the Thalamkudah area; these white sand occurrences are extended in nearly 750m wide coastal stretch for about 250 widths (Plate – V). Most section of the glass sand occurrence is occurred in government owned land area.

During field investigations it was observed that part of the glass sand bearing area (close proximity to the A4 main road) is being blocked out for some reasons, possibly for human settlements. Therefore, it is highly recommended to reserve the area covered by glass sand occurrences so that glass manufacturing industry could be commenced in the area in near future.

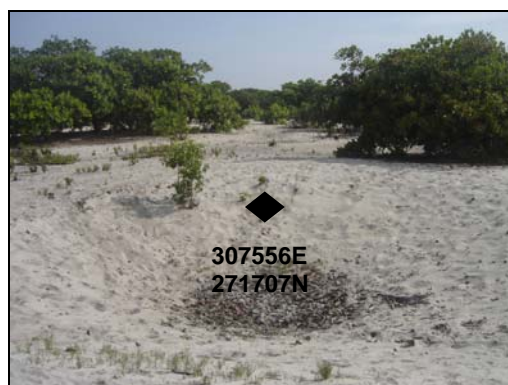


Plate – V: Occurrence of glass sand in Thalamkudah area

6. Brick and Tile Clay

In the Nellupodiyagal area, deep red brick and tile clay occurrences are identified in about 400m long and 200m wide area. The clay bed occurs as 1.5m thick bed, bordering paddy field. After mining, the land could be converted to a paddy field.

7. Ground Water

In the area of Thalamkudah there are shallow dug wells located in a good sand aquifer which are used for individual houses. This aquifer has potential for further resources.

Also in the areas of Kirankulam and Kaluthavalai, similar sand aquifers are used for irrigation of cash crops, which also has potential for further development via agro wells.

8. Shell Beds

Shells are collected by hand picking in Muhathuwaram – Navaladi stretch in the Batticaloa Lagoon. These activities are conducted in cottage level. Mined shells are transported to the Arayampathy area to burn lime.

9. Lime Burning Industry

Lime burning industry is conducted in cottage level in the Arayampathy area, near 419km post of A4 main road (Plate IX) Number of families are engaged in this industry. Shells mined from Muhathuwaram to Navaladi stretch in the Batticaloa Lagoon are used as raw materials for lime burning industry at this location.



Plate – IX: Lime burning industry is in operation in Arayampathy area

10. Gravel Pits

Light brown colour gravel materials originated by weathering of granitic gneiss rock are currently being mined in the Kathiraveli area. These gravel pits are located next to an existing quarry. It was noted that section of mined pits had already been filled (Plate – XA). The mined gravel is being used for road surfacing. However, it is necessary to check the suitability of mined gravel for road surfacing activities, as the mined gravel from this area is appeared to be low in quality.



Plate – XA: Gravel mined water stagnated pits. Part of pits in the area has been filled

Number of reddish brown pegmatitic gravel pits good for road surfacing is found at many places in the study area. Some of these are abandoned at present (Plate – XB). Considerable amount of further reserves are available for mining. The gravel beds are located in an isolated 4 - 5m high small ridge structures. Most of the already mined pits have not been filled.



Plate –XB: An abandoned gravel pit

11. Metal Quarries

Number of different size existing and abandoned metal quarries exists within the study area. In addition, number of potential sites, good for opening up of metal quarries was also identified during the survey. These include migmatitic gneiss, pink granitic gneiss and hornblende bearing pink granitic gneiss. These quarry locations are identified in Kathiraveli, Verugal, Mullivattavan and Kusalanagama, areas. Of these quarries, some are currently operating after getting mining licenses. On the other way it appeared that most of the abandoned quarries were operated without having a valid mining license.

7.3 Mineral Occurrences within the NECCDEP Area of Ampara District

Following mineral occurrences were identified within the area covered by NECCDEP Zone in the Ampara District during the rapid field assessment

1. Mineral Sand
2. Construction Sand (River Sand)
3. Glass Sand
4. Ground Water
5. Gravel Pits
6. Metal Quarries

1. Mineral Sand

Economically viable mineral sand occurrences are observed in coastal stretch of Thirukkovil. It is bounded by mouth of the Periya Muhattuwaran Lagoon. Mineral sand occurrences are extended in 2.5km length along the beach and nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone, berm zone and in low dunal area (Plate – IA).



Plate – IA: Mineral sand occurrence in Thirukkovil Deposit

In addition, mineral sand concentration in sand dunes in Panama area is also somewhat promising for mining. The sand dunes are 6 – 8m high and extend for few kilometers along the coast. Further, economically viable mineral sands are also identified in the tidal and berm zones as well (Plate – IIB).



Plate – IB: Presence of mineral sand in 6 – 8m high sand dunes in Panama area

2. Construction Sand (River Sand)

Existing sand mining sites are located in the Kallodai Aru stream bed within the study area. Sand is mined from river bed and in both banks of the Kallodai Aru stream. In this stream, exposed sand bars are also identified at places. They too could be mined. The Kallodai Aru stream exists parallel to Oluvil – Deegawapi road in W – E direction.



Plate – IA: Sand occurrences in Kallodai Aru Stream near Oluvil

In addition, another river sand mining area is identified in the Heda Oya at Yamanthurai in Nawalur. Beyond 500m upstream from the bridge across the Heda Oya along the Pothuvil – Panama main road, river sand are mined from stream bed and in both flood plains. Few metres high, several tenths of metres long and 10 – 15m wide sand bars are identified within the Heda Oya stream path and the mineable areas extended for 1 – 2km distance along the Heda Oya.

River sand mining could be commenced in river bed and in both stream banks of the Neethai Aru stream. It is recommended to commence sand mining activities in about 250m upstream from the bridge across the Neethai Aru stream along the Akkaraipattu – Sagama road. The 250m distance is selected by considering the relatively small size of the stream

River sand mining could also be commenced in river bed and in both stream banks of the Telipola Aru stream. It is recommended to commence sand mining activities in about 250m upstream from the bridge across the Telipola Aru stream along the Akkaraipattu – Sagama road. The 250m distance is selected by considering the relatively small size of the stream

Furthermore, another current sand mining location is identified in the Karanda Oya (near the Pottuvil – Siyambalanduwa main road crossing point),

3. Glass Sand

White sand occurrences suitable for manufacturing of glass products are occurred in the Manalchena area. These white sand occurrences are extended for few acres in extent.



Plate – IV: Occurrence of glass sand in Manalchena area

4. Ground Water

Below the above glass sand deposit is a shallow aquifer of potable quality water, in which dug wells are located. This aquifer has high potential for further development of water resources.

5. Gravel Pits

Number of reddish brown pegmatitic gravel pits good for road surfacing is found at many places in the study area. Of these, gravel pits in the Komari area is prominent (Plate – VA). They occur as 5 – 7m high ridges and are spread in about 5 – 7 acre area. Currently, gravel is mined from the Komari occurrence to use in road development work. These materials are resting on the top of charnockitic rocks, as weathered overburden cover. Large reserves are further available for mining.



Plate – VA: Gravel beds in Komari area

In addition, reddish brown pegmatitic gravel which is good for road surfacing work is found in number of localities. Of them, some are working gravel pits (Plate – VB) while others are abandoned pits. However, considerable amount of further reserves could be mined from all the locations. All these sites are located in 3 -4 m high small scattered ridges. Already mined pits have not been filled. Current mining is conducted in an unsystematic manner.



Plate – VB: Existing gravel pit in the study area

6. Metal Quarries

Number of different size existing and abandoned metal quarries exists within the study area. In addition, number of potential sites, good for opening up of metal quarries was also identified during the survey. These include massive charnockite, charnockitic gneiss, migmatitic gneiss, pink granitic gneiss and hornblende bearing pink granitic gneiss. These quarry locations are identified in Sangamankanda (Plate – VIA), Kannakipuram, Sasthraveli (Plate – VIB), Komari, Ulpassewewa, Pansalgoda, Kottevehera areas etc., Kathiraveli, Verugal, Mullivattavan, Kannakipuram (Plate – VIC & D) and Kusalaganama areas. Of these quarries, some are currently operating quarries after obtaining mining licenses. On the other way it appeared that most of the abandoned quarries were operated without having a valid mining license.

Of these quarries, massive charnockite rock quarry at Sangmankanda is significant when consider the road development work (Plate – VIA). This rock is spread in about 1square kilometer area.



Plate – VIA: Massive charnockite rock in Sangamankanda quarry



Plate – VIB: Existing charnockitic gneiss quarry at Sasthraveli Village



Plate – VIC

Plate – VIC: An abandoned quarry in Kannakipuram



Plate – VID

Plate – VID: Working quarry in Kannakipuram

SECTION 8: CURRENT EXPLOITATION & MANAGEMENT AND FURTHER EXPLOITATION OF MINERAL RESOURCES

Under chapter 6 and 7 a total of 12 separate mineral resources are identified from 6.1 to 6.12. Most of these resources are under utilized by way of exploitation. The main **under utilized** minerals are the following:

- Mineral Sands (Pulmuddai and smaller deposits)
- Construction Sand (River and Dune sands)
- Metal Quarries (Working and Abandoned)
- Gravel Resources
- Potable Ground Water
- Salterns (Abandoned and Proposed)

The details of the above are provided in **Annexes I, II and III**, with details of the present status, and potential exploitation, with **comments for decision makers**.

Management of these resources are considered **from adequate resources**. Therefore the involvement of the Pradeshiya Sabha, Divisional Secretariat, and District Secretariat will be necessary to improve the management of under utilized resources. It is necessary that these authorities co-ordinate with the relevant Government Departments such as **CCD, Forest Department**, and **GSMB**, to obtain the necessary clearances, and licenses, for the NECCDEP community to exploit its mineral resources with Authority for their **financial upliftment and sustenance**.

It is important to focus on the only mineral Sands beneficiation plant in Sri Lanka, at Pulmuddai. Mineral Sands Limited will be required to have a vision for the export marketability of its products, with its marketing arm, along with Government Authorities promoting such exports. Production is expected to capture the foreign market for efficient management of resources. Other than the main deposit at Pulmuddai there are smaller deposits along the eastern coast for potential primary beneficiation. Such deposits could be worked based on the market demand. Based on the requirement, the management of these minor mineral sands will have to be revitalized in order to serve the NECCDEP community, for enhanced financial benefits in working the scattered smaller mineral sand deposits, along the coast.

A further exploitation of the 12 listed mineral resources will be based on demand where such demand is not confined only to the Eastern Province. The **under utilized resources** listed under section 7 will be in demand outside the province, based on the National Development Projects that have been earmarked.

All **under utilized** resources need not be exploited on a short term basis. Reserves in the Eastern Province, especially for the community targeted by the NECCDEP will need attention. Therefore a balance needs to be arrived at by the relevant Government Authorities on further exploitation and **reserves for the future**.

Further exploitation can be based on **market demands**, especially outside the Eastern Province, for National Development, and for foreign earnings – such as **Mineral Sands** for the **export market**.

SECTION 9: CONCLUSION AND RECOMMENDATIONS

In this report all relevant minerals of the NECCDEP project area have been taken into account. In this context we have provided Annexes **I, II, and III** which give all the deposits with **GPS readings** and **GIS maps**. In these Annexes the status of each deposit is mentioned, along with comments for future development. The sections of this **report from 6.1 to 6.12**, gives a summary with tables, when necessary, along with **comments for decision markers**, along with required guidelines.

Further exploitation should be based on market demand only, along with reserves for future exploitation. This will require the local authorities to co-ordinate with the relevant Government Authorities to arrive at a **consensus**.

Where **recommendations** are concerned the entire context of this report is on focus. The under utilized resources are given in chapter 9. Recommendations for each mineral resource are provided under **Tabulated Annexes I, II, and III**, and also under section 6.

The final conclusion is that most of the mineral resources remain under utilized. Further exploitation is required only based on the market demands, both within and outside the Eastern Province, mainly on projected National Developments.

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ANNEX - I

Identified Mineral Occurrences (category wise) within NECCDEP Zone Covering Trincomalee District

No.	Village	GPS Co-ordinates	Mineral / Rock	Remarks
2	Challimunar	234226E 404969N	Mineral sand	Spreads for 200 m distance along the coast. GPS point is centre point
3	Wadalikulam	234871E 401442N	Metal Quarry	Massive charnockite; Existing quarry; Good for road construction work; Workable length – 300m, width – 30m & height – 20m; Scattered rock outcrops occur in the ridge.
4	Kuchchaweli	235585E 401418N	Ground Water	Both sides of the road around Kuchchaweli town limits, good ground water bearing area exists. Sandy Aquifer
6	Salapei Aru	237880E 397094N	Metal Quarry	Pink Granitic Gneiss. No. of abandoned quarries were identified along nearly 1km long ridge structure in its Eastern slope. Mining activities were terminated due to LTTE activities. Recommended for few IML-B category quarry projects. GPS point is centre point. Workable length – 50m, width – 30m & height – 20m.
7	Salapei Aru Tsunami Village	238185E 397187N	Ground Water	Good ground water bearing area. Sandy Aquifer. Using 3 dug wells, water is pumped for 200 houses
9	Periyakarachchi	240176E 394755N	Proposed Saltern	Proposed Saltern in 1805 acre area in the lagoon. GPS point is centre point
10	Nilaweli	245813E 385629N	Abandoned Saltern	Nilaweli saltern abandoned in eighties. Potential site for re-commencing the industry. GPS point is centre point.
11	Southern end of Kokilai Lagoon (northern end of Pulmoddai mineral sand deposit)	221234E 419469N	Mineral Sand	Northern boundary zone of Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd. Mineral sand occurrences are extended for nearly 100-150m width in beach plain.
12	Pulmoddai	221863E 418380N	Mineral Sand	Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd.. Mineral sand occurrences are extended for nearly 100-150m width in beach plain
13	Pulmoddai	223262E 416475N	Mineral Sand	Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd.. Mineral sand occurrences are extended for nearly 100-150m width in beach plain
13a	Southern end of	225210E	Mineral Sand	Southern boundary zone of Pulmuddai mineral sand mining

	Pulmoddai mineral sand deposit	414025N		area by Lanka Mineral Sand Ltd.. Mineral sand occurrences are extended for nearly 100-150m width in beach plain
14	Pulmoddai	223659E 415640N	Construction Sand	After refining mineral sands, remaining sands were piled up for nearly 100m long, 50m wide & 10-12m high and 125m long, 50m wide & 12-14m high two sections within the LMS Ltd premises. These sands could be used for construction activities. GPS point is northern end of sand piled up area.
15		226168E 409323N	Metal Quarry	Pink Granitic Gneiss; Potential quarry location; Strike ridge structure covered by secondary vegetation. Workable length – 300m, width – 30m & height – 15m.
16		226139E 404656N	Construction Sand (River Sand)	Existing sand mining location in a stream. This place is good for artisanal mining.
17		226223E 404265N	Metal Quarry	Pink Granitic Gneiss; Abandoned quarry. But potential location to re-commence quarrying activities; Workable length – 50m, width – 25m & height – 15m.
18	Kallanpathai	225810E 403740N	Metal Quarry	Pink Granitic Gneiss; New potential location to commence quarrying activities; Workable length – 300m, width – 50m & height – 25-30m.
19	Illandeikulam	227559E 402261N	Gravel Pits	Light yellowish brown colour gravel materials originated by weathering of granitic gneiss rock; Large numbers of abandoned gravel mined pits are encountered in about 200m x 150m size land area. In this area unsystematic mining was conducted in about 2-5m below the ground surface. None of the mined pits were rehabilitated and as a result of water stagnating is observed. This feature is a severe environmental hazard of the area. It is proposed to rehabilitate the mined pits by converting them to a tank and thereby fresh water fish breeding could be done. GPS point is centre point.
20		229014E 401732N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Numbers of abandoned gravel mined pits are encountered in about 100m x 50m size land area. In this area mining was conducted in about 1.5-2m below the ground surface. This area is recommended for further gravel mining in systematic manner; So far, none of the mined pits were rehabilitated and it is

				proposed to fill them by using overburden materials, after mining is completed. GPS point is centre point.
21	Varadikulam	234648E 401211N	Metal Quarry	Charnockitic Biotite Gneiss; Abandoned quarry; Potential to re-commence mining activities under IML – C category; Workable length – 75m, width – 30m & height – 8m.
22	Kumburupiddi	242058E 393014N	Ground Water	Both sides of the road around Kumburupiddi village, potential ground water bearing area exists for more than 1km distance along the road. Sandy Aquifer; Presently, ground water in this area is being pumped by constructing number of agricultural wells.
24		247043E 381131N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Large number of abandoned and working gravel pits are encountered within the weathered overburden cover of about 10 – 12m high quartzite strike ridge structure which is trending in 045°/75° direction for about 1.5 – 2 km distance. In both sides of the ridge structure, large numbers of gravel pits are identified. GPS point is taken at the crossing point of quartzite ridge structure with Nilaweli – Trincomalee road.
25		248328E 378585N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Large number of abandoned and working gravel pits are encountered within the weathered overburden cover of about 08 – 10m high quartzite strike ridge structure which is trending in 070°/80° direction for several km distances. In both sides of the ridge structure, large numbers of gravel pits are identified. However due to presence of houses, gravel pits in SE slope of the ridge is limited. GPS point is taken at the crossing point of quartzite ridge structure with Nilaweli – Trincomalee road.
27	Andankulam	245490E 377083N	Metal Quarry	Pink Granitic Gneiss; Existing quarry; Workable length – 100m, width – 25m & height – 25m.
28		246961E 376061N	Gravel Pit	Reddish brown quartzitic gravel; Good for road surfacing; Gravel pit is located near to the Trincomalee – Anuradhapura main road. Considering its close proximity to the main road, it is

				recommended to re-commence mining activities. Existing size of the pit is 40m in length and 5m in height. However, gravel bearing ridge is continuing for several hundred metres parallel to the main road. Gravel could be mined from both sides of the ridge
29	Trincomalee Technical College Premises	247088E 375973N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Gravel pit is located near to the Trincomalee – Anuradhapura main road (in Technical College premises) Quartzite ridge is extending in either side of the road (ridge is trending perpendicular to the main road) Due to the presence of Technical college and number of houses within the ridge, only selective mining could be done at pre-identified locations.
30	Andankulam	245333E 377100N	Metal Quarry	Charnockitic Gneiss with metre scale inter banded granitic gneiss layers; Existing large quarry; This quarry is located in western slope of ridge structure where location 27 quarry is situated. In addition, several quarries are encountered in both slopes of this ridge; Workable area in this entire ridge structure is 400m long, 50m wide and 25m high.
31	Anuradhapura – Trincomalee road	244571E 377583N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Number of gravel pits are located in the eastern slope of the quartzite ridge structure which is extending for few km distance; Towards further southern direction, no existing gravel pits are identified. However, it is possible to open up number of gravel pits in this section. This ridge is crossing the Trincomalee – Anuradhapura main road and the ridge is trending in perpendicular to the road.
32	Within the Air Force Base in Trincomalee (along the Kinniya – China Bay road)	246174E 369903N	Gravel Pit	Reddish brown weathered quartzitic overburden materials are encountered in the quartzite band located within the Air Force base premises, parallel to the Kinniya – China Bay main road.
33	Nachchikudah	245571E 368503N	Gravel Pit	Reddish brown weathered quartzitic overburden materials are encountered at the bottom of quartzite band located opposite the Thambalagam Bay in Kinniya – China Bay main road. Presently, gravel is being mined from this location
34	Munaichenai	243840E	Existing Saltern	Seasonal saltern is located in both sides of the Kinniya –

		364204N		Thambalagamuwa main road, near 11 th km post. It is owned by several private personnel. During maha season, saltern is not functioned due to its high water table. GPS point is centre point of saltern, on the road
35	Kachchakoditivu	243102E 363614N	Existing Saltern	Seasonal saltern is located in right hand side of the Kinniya – Thambalagamuwa main road, in front of Kinniya Pradeshiya Sabha between 11 th and 12 th km posts. It is owned by several private personnel. During maha season, saltern is not functioned due to its high water table. GPS point is taken from the boundary zone of saltern at the Kinniya – Thambalagamuwa main road.
36	Alankerny	246002E 365402N (western boundary)	Mineral Sand	Garnet rich black mineral sands are mainly concentrated within the berm zone of beach in the Kinniya – Mutur road. In this stretch, mineral sand could be mined by scraping the beach zone upto 0.3m depth.
37	Alankerny	246421E 363825N (eastern boundary)	Mineral Sand	Garnet rich black mineral sands are mainly concentrated within the berm zone of beach in the Kinniya – Mutur road. In this stretch. In this stretch, mineral sand could be mined by scraping the beach zone up to 0.3m depth.
38	Neelapola	248955E 352672N	Construction Sand (River Sand)	Large scale sand mining activities are conducted in Neelapola area in the right bank of the Mahaweli river, within the Wildlife Sanctuary. Sand mining activities are limited to the right bank of the river.
39	Wellanaval	248955E 352672N	Construction Sand (River Sand)	Medium scale sand mining activities are conducted in Wellanaval area in the right bank of the Mahaweli river, within the Wildlife Sanctuary. Sand mining location could only be reached by a boat and is about 4km away from the sand stockpiling area at Ralkuddi. Mined sand are transported to Ralkuddi area near west of Mutur by boats.
40	Siri Mangalapura	253355E 343853N	Brick Clay	In this area, brick clay occurrences are identified in about 100 – 200 acre land. The entire area is appeared to be an ancient flood plain (possibly ancient flood plain of Mahaweli River). Its thickness is about 1-1.5m. Nearly 100 families are engaged in brick manufacturing industry by mining this clay bed. The entire

				land belongs to the Forest Department.
41	Siri Mangalapura	252920E 343922N	Construction Sand (Land Based Sand in ancient River Course))	Below the 1-1.5m thick brick clay bed at Sri Mangalapura area (refer loc. No. 40), about 4-6m thick sand occurrences are encountered. Few years back, some outsiders started mining these land based sand occurrences. But, due to strong opposition of villagers they had to abandon the mining activities.
42	Seruwila	259819E 345962N	Cu – Fe Deposit	Seruwila Cu-Fe body is centred on this location. It occurs as a series of lenticular pods arranged along the regional strike and is spread over an area of nearly 10 square kilometres. Its mineralization, mainly magnetite and copper minerals – chalcopyrite, bornite, malachite and azurite, etc., is restricted to basic metamorphic rocks. It occurs in three discrete blocks, namely, Arippu, Block – B and Kollankulam Blocks.
43	Seruwila New Temple Road	260215E 347588N	Metal Quarry	Pink Granitic Gneiss; Existing minor quarry; Scattered outcrop with boulders; About 6 persons are involving mining activities of this rock at different places; Workable area of entire rock is as follows length – 300m, width – 35m & height – 15m. GPS is taken in the centre point of quarrying area.
44	KawantissapuraSeruwila New Temple Road	260144E 349163N	Metal Quarry	Charnockitic Biotite Gneiss; Existing minor quarry; Small outcrop; Workable length – 30m, width – 15m & height – 5m. GPS is taken in the centre point of quarrying area.
45	Punagar near Echchalampattu	263055E 342341N	Brick Clay	In this area, brick clay occurrences are identified in about 50 acre land. Its thickness is about 1-5m. Brick manufacturing industry is largely taken in the area by mining this clay bed.
46	Mawadichenai	264290E 339722N	Construction Sand (River Sand)	Construction sand mining activities are conducting on large scale from the Verugal Aru stream bed and stream banks. In the right bank of the river, sharp bend is observed and large sand bar has formed at this location. Workable length – 500m, width – 100m & height – 1.5m. GPS is taken in the centre point of mining area.
47	Mawadichenai	266351E 340060N	Metal Quarry	Pink Hornblende Granitic Gneiss; New potential quarry site for operating IML – C category quarry. Workable length – 150m, width – 35m & height – 15m. GPS is taken in the centre point.
48	Verugal	265910E 339075N	Metal Quarry	Pink Hornblende Granitic Gneiss; New potential quarry site for operating IML – C category quarry. Workable length – 100m,

				width – 20m & height – 15m. GPS is taken in the centre point.
49	Palchenai	271325E 333395N	Mineral Sand	Southern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
49a	North of Verugal Aru Mouth	268725E 342571N	Mineral Sand	Northern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
50	North of Lankapatuna	267743E 350629N	Mineral Sand	Southern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
50a	Uppural	266203E 354807N	Mineral Sand	Northern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
51	Bogaspitiya	244448E 347433N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
51a	Bogaspitiya	244604E 347623N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
52	Kinniyapitiya	245343E 347866N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
52a	Kinniyapitiya	245754E 347988N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
53	Kotiyapitiya	244836E 347687N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
53a	Kotiyapitiya	245258E 347747N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
54	Sunken Lanka	243829E 346887N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
54a	Sunken Lanka	244477E	Construction	Sand mining in Mahaweli River. North of Siththaru Bridge near

		347326N	Sand (River Sand)	Kantale
55	South of Sunken Lanka	244031E 346384N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
55a	South of Sunken Lanka	243946E 346558N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
56	East of Kinniyapitiya	245767E 347803N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
56a	East of Kinniyapitiya	246111E 347737N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
57	West of Kinniyapitiya	246011E 347855N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
57a	West of Kinniyapitiya	246172E 348014N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
58	Kanniya	221450E 386550N	Hot Water Springs	<p>Hot water springs are located in Kanniya, near Trincomalee; Average temperature of these hot water wells is 42⁰C; Total of five wells are located adjacent to each other; All these hot springs smell characteristic hydrogen sulphide gas and they have been developed by Kanniya Pradeshiya Sabha for spa / hot water bathing for tourists.</p> <p>Detailed investigations are needed to check the possibility of use of hot water springs for power generation. Utilization of hot dry rock geothermal energy is another option that needs to be investigated.</p> <p>GPS is taken in the centre point of hot water springs.</p>
59	Koduwakattu	232100E 405450N	Mineral Sand	Southern boundary zone of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly

				500-700m width in beach plain.
60	Koduwakattu	230000E 407000N	Mineral Sand	Middle section of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain.
61	Koduwakattu	228450E 408650N	Mineral Sand	Middle section of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain.
62	Kalarawa	227400E 410300N	Mineral Sand	Northern boundary zone of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain.
63	Kuchchaveli	235800E 401500N	Mineral Sand	Kuchchaveli sand body. Mineral sand occurrences are extended for nearly 75-100m width in beach plain.
64	Periakarachchi	240750E 395300N	Mineral Sand	Southern boundary zone of Periyakarachchi mineral sand body. Mineral sand occurrences are extended for nearly 100-500m width in beach plain.
65	Periakarachchi	240000E 395800N	Mineral Sand	Northern boundary zone of Periyakarachchi mineral sand body. Mineral sand occurrences are extended for nearly 100-500m width in beach plain.

ANNEX - II

Identified Mineral Occurrences (category wise) within NECCDEP Zone Covering Batticaloa District

No.	Village	GPS Co-ordinates	Mineral / Rock	Remarks
1	Verugal	266122E 337633N	Metal Quarry	Hornblende Biotite Migmatitic Gneiss; Abandoned quarry; Abandoned due to presence of Archaeological Importance Features on the top of rock exposure. However, massive crushing plant is located at this quarry site to crush rock materials bringing down from location no. 2.
2	Kathiraveli	266749E 334869N	Metal Quarry	Grayish Colour Granitic Gneiss; Existing quarry belongs to China Harbour Engineering Company; At this place rock blasting and breaking is taken place and Blasted and broken rock materials are transported to crusher plant located at Verugal (location no. 1) for crushing; Rock materials are used for development work of Vakara – Varugal stretch of Batticaloa – Trincomalee road (A 15).
3	Kathiraveli	266906E 334783N	Gravel Pits	Light brown colour gravel materials originated by weathering of granitic gneiss rock are currently being mined; These gravel pits are located next to the existing quarry at location no. 2 in its eastern direction. It was noted that section of mined pits had already been filled. The mined gravel is being used for road surfacing. However, it is necessary to check the suitability of mined gravel for road surfacing activities, as the mined gravel from this area is appeared to be low in quality.
4		273554E 315267N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered within a 200m long, 75m wide and 3m deep section; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 5m high small ridge structure. Already mined pits have not been filled. GPS point is taken at the centre point of gravel bearing section.
5	Mullivattavan in Vakaneri	268917E 303798N	Construction Sand (River Sand)	Existing river sand mining location in Maduru Oya river bed and flood plain; In this location, medium to coarse grained good quality sand bar is encountered in nearly 400m long, 30m wide and 1.5m high section. GPS point is taken at the centre point of sand bearing area.
6	Mullivattavan in	272667E	Metal Quarry	Migmatitic Gneiss; New potential location to commence quarrying

	Vakaneri	302110N		<p>activities; The entire outcrop is exposed in about 1 square kilometer area. Of this amount, nearly half is boarding the Vakaneri Tank. Hence, not recommended for mining. Of the balance half, the southernmost section is exposed upto 10m from the ground level and is located few hundred metres away from the tank. Hence it is possible to mine.</p> <p>GPS point is taken at the centre point of gravel bearing section.</p>
7	Near 124km post of Polonnaruwa – Trikonamadu main road	276493E 304734N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered within a 500m long, 100m wide and 2m deep section in both sides of Polonnaruwa – Trikonamadu main road; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 6m high small ridge structure. Already mined pits have not been filled.</p> <p>GPS point is taken at the centre point of gravel bearing section.</p>
8	Nellupodiyagal	287481E 282502N	Brick Clay	<p>Deep red clay bed; Good for manufacture of bricks; It occurs as 1.5m thick bed, bordering paddy field. After mining, the land could be converted to a paddy field. The clay bed is extended for 400m long and 200m wide area.</p> <p>GPS point is taken at the centre point of clay bearing area.</p>
9	Palchenai	284311E 280002N	Construction Sand (Manufactured Sand)	<p>Quartzite ridge; Weathered overburden materials of this quartzite ridge have already been mined to get gravel for road surfacing; Currently, only quartzite rock is available at this location and is extended as few hundred metres long, nearly 40m wide and 7 – 10m high strike ridge structure. The entire ridge is situated in an isolated location; No human settlements are observed at the vicinity of this quartzite ridge structure and it is covered by paddy fields; It is possible to use quartzite rock materials of this ridge structure for preparation of manufactured sand by crushing.</p> <p>GPS point is taken at the crossing point of quartzite ridge structure with Iluppachchenai - Toppigala road.</p>
10	Mavadi Odai	280650E 279600N	Construction Sand (River Sand)	<p>Currently, sand is mined from the river bed and both banks of Mavadi Odai stream, about 500m upstream of Mavadi Odai bridge along Iluppachchenai - Toppigala road; At this location, medium to coarse grained good quality sand is observed.</p>

				GPS point is taken at the centre point of sand bearing area.
11	Mavadi Odai	280850E 279900N	Construction Sand (River Sand)	Currently, sand is mined from the river bed of Mavadi Odai branch stream. The Mavadi Odai branch stream is located about 100m west of Mavadi Odai main stream, along Iluppadihchenai - Toppigala road; At this location, medium to coarse grained good quality sand is mined from the river bed and it's both banks. GPS point is taken at the centre point of sand bearing area.
12	Kusalanagama	282249E 278834N	Metal Quarry	Hornblende bearing Pink Granitic Gneiss; Existing quarry; Quarry materials are being used for development work of Chenkalady – Maha Oya main road by a private party. Crusher plant is also available about 300 - 400m away from the quarry site; Workable length – 75m, width – 40m and height – 15m. A large rock exposure is observed in close proximity to this quarry site. But due to presence of Archaeological features, the rock cannot be mined. GPS point is taken at the centre point of the quarry site
13	At 279km post of Chenkalady – Maha Oya main road	287721E 283455N	Gravel Pit	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in both sides of the main road; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 2 - 4m high small ridge structure. Already mined pits have not been filled. GPS point is taken at the crossing point of gravel bearing area with Chenkalady – Maha Oya main road.
14	Palamadu	281700E 284085N	Construction Sand (River Sand)	Existing sand mining location in Levaru Aru stream; Considerable amount of sand is mined from the sand bar in the river bed and in both banks. The mined sand is transported to stockpiling area located about 500m away. GPS co-ordinates of stock piling area are 281527E / 283652N).
15	Muhathuwaram in Batticaloa Lagoon	302375E 282225N	Shell Beds	Northern boundary zone of shells collected area; Shells are collected by hand picking in Muhathuwaram area in Batticaloa Lagoon; These activities are conducted in cottage level.

				GPS point is taken at the centre point of lime burning industry prevailing area.
15a	Navaladi in Batticaloa Lagoon	302725E 281225N	Shell Beds	<p>Southern boundary zone of shells collected area; Shells are collected by hand picking in Navaladi in Batticaloa Lagoon; These activities are conducted in cottage level.</p> <p>GPS point is taken at the centre point of lime burning industry prevailing area.</p>
15b	Arayampathy	306667E 273112N	Lime Burning Industry	Lime burning industry is conducted in cottage level in Arayampathy area, near 419km post of A4 main road; Number of families are engaged in this industry; Shells mined from Muhathuwaram in Navaladi in Batticaloa Lagoon are used as raw materials for lime burning industry at this location.
16	Thalamkudah	307556E 271707N	Glass Sand	<p>White sand occurrences which are suitable for manufacture of glass products are identified in Thalamkudah area; These white sand occurrences are extended in nearly 750m wide coastal stretch for about 250 width. Most section of the glass sand occurrence is occurred in government owned land area.</p> <p>During field investigations it was observed that part of the glass sand bearing area (close proximity to the A4 main road) is being blocked out for some reasons, possibly for human settlements. Therefore, it is highly recommended to reserve the area covered by glass sand occurrences so that glass manufacturing industry could be commenced in the area in near future.</p> <p>GPS point is taken at the centre point of white sand occurrences.</p>
17	Marnkerni	279043E 312015N	Mineral Sand	Northern boundary zone of black mineral sand rich area along the coast; Black sand concentration is rich in both tidal and berm area; Black sands are extended in nearly 40m wide stretch in landward direction.
17a	Keelikudah	280987E 310288N	Mineral Sand	Southern boundary zone of black mineral sand rich area along the coast; Black sand concentration is rich in both tidal and berm area; Black sands are extended in nearly 40m wide stretch in landward direction.

ANNEX - III

Identified Mineral Occurrences within NECCDEP Zone Covering Ampara District

No.	Village	GPS Co-ordinates	Mineral / Rock	Remarks
1	Kallodai Aru in Oluvil	317394E 232342N (eastern boundary zone of sand mining area in Kallodai Aru)	Construction Sand (River Sand)	Eastern boundary zone of sand mining area of Kallodai Aru stream within the study area. Sand is mined from river bed and in both banks of Kallodai Aru stream. In this stream, exposed sand bars are also identified at places. They too could be mined. Parallel to Oluvil – Deegawapi road, Kallodai Aru stream exists in W – E direction.
1a	Kallodai Aru in Oluvil	316430E 232194N (western boundary zone of sand mining area in Kallodai Aru)	Construction Sand (River Sand)	Western boundary zone of sand mining area of Kallodai Aru stream within the study area. Sand is mined from river bed and in both banks of Kallodai Aru stream. In this stream, exposed sand bars are also identified at places. They too could be mined. Parallel to Oluvil – Deegawapi road, Kallodai Aru stream exists in W – E direction.
2	Oluvil – Deegawapi road	315027E 231986N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned and working gravel pits are encountered within a 300m long, 100m wide and upto 3m deep section; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 5m high small ridge structure. Already mined pits have not been filled. Current mining is conducted in an unsystematic manner. GPS point is taken at the centre point of gravel bearing section.
3	Oluvil – Deegawapi road (near Deegawapi)	314249E 231819N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered within a 350m long, 150m wide and upto 3m deep section; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 5m high small ridge structure. Already mined pits have not been filled. . Current mining is conducted in an unsystematic manner. GPS point is taken at the centre point of gravel bearing section.
4	Kannakipuram	315627E 219868N	Metal Quarry	Granitic Gneiss; Existing quarry; Workable area; Length – 75m, Width – 25m Height – 10m. Nearly 300m away from this quarry location, about 35 – 40m high large

				<p>rock exposure is situated in SW direction. Two abandoned quarries are located within this rock exposure. Due to presence of number of nearby houses, both of these quarries had to be abandoned few years back.</p> <p>GPS point is taken at the western boundary of the quarry.</p>
5	Neethai Aru in Akkaraipattu – Sagama road	314808E 218405N	Construction Sand (River Sand)	<p>River sand mining could be commenced in river bed and in both stream banks of the Neethai Aru stream. It is recommended to commence sand mining activities in about 250m upstream from the bridge across Neethai Aru stream along Akkaraipattu – Sagama road. The 250m distance is selected by considering the relatively small size of the stream</p> <p>GPS point is taken at the eastern boundary zone of proposed sand mining area.</p>
6	Telipola Aru in Akkaraipattu – Sagama road	313204E 214806N	Construction Sand (River Sand)	<p>River sand mining could be commenced in river bed and in both stream banks of the Telipola Aru stream. It is recommended to commence sand mining activities in about 250m upstream from the bridge across Telipola Aru stream along Akkaraipattu – Sagama road. The 250m distance is selected by considering the relatively small size of the stream</p> <p>GPS point is taken at the eastern boundary zone of proposed sand mining area.</p>
7		315646E 210744N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel mined area.</p>
8		317078E 210602N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in either side of the Akkaraipattu – Pothuvil main road. Considerable amount of further reserves are available for mining. The gravel bed is located in an</p>

				isolated 3 - 4m high small ridge structure. Already mined pits have not been filled. Mining was conducted in an unsystematic manner. GPS point is taken at the centre point of gravel mined area.
9	Thirukkivil	319993E 216559N	Mineral Sand	Northern boundary zone of mineral sand occurrences along the Thirukkivil coastal stretch. It is bounded by mouth of Periya Mottuwaran Lagoon. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone.
9a	Thirukkivil	319819E 215572N	Mineral Sand	Inside point of mineral sand occurrences along the coastal stretch in Thirukkivil. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone
9b	Thirukkivil	319701E 214553N	Mineral Sand	Inside point of mineral sand occurrences along the coastal stretch in Thirukkivil. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone
9c	Thirukkivil	319691E 213986N	Mineral Sand	Southern boundary zone of mineral sand occurrences along the Thirukkivil coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone.
10	Manalchena	321247E 201361N	Glass Sand	White sand occurrences suitable for manufacturing of glass products are occurred in Manalchena area. These white sand occurrences are extended for few acres in extent. GPS point is taken at the centre point of glass sand occurrences.
11	Sangamankanda	320096E 200487N	Gravel Pits	Reddish brown lateritic soil cover is encountered as the overburden cover of 12 – 15m high ridge structure at Sangamankanda area; Below the lateritic soil cover, charnockite rock is observed; These lateritic soil cover is appeared to be formed as a result of lateritization process of charnockite rocks; Part of the lateritic soil cover has been mined to get gravel for road surfacing; This lateritic soil cover is extended for 5 – 6 acre area. The entire ridge is situated in an isolated location; No human settlements are observed

				at the vicinity of this lateritic soil cover; Considerable amount of gravel materials could be mined by further cutting of this lateritic overburden cover. GPS point is taken at the centre point of glass sand occurrences.
12	Komari	320358E 197208N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure identified in either side of the Akkarapattu – Pothuvil main road. Already mined pits have not been filled. Mining was conducted in an unsystematic manner. GPS point is taken at the centre point of gravel mined area.
13	Yamanthurai, Nawalur	313750E 180000N	Construction Sand (River Sand)	Eastern boundary zone of river sand mining area in Heda Oya at Yamanthurai in Nawalur. Beyond 500m upstream from the bridge across Heda Oya along the Pothuvil – Panama main road, river sand could be mined from stream bed and in both flood plains. Few metres high, several tenths of metres long and 10 – 15m wide sand bars are also identified within the Heda Oya stream path.
13a	Yamanthurai, Nawalur	312260E 180215N	Construction Sand (River Sand)	Western boundary zone of river sand mining area in Heda Oya at Yamanthurai in Nawalur. River sand could be mined from stream bed and in both flood plains. Few metres high, several tenths of metres long and 10 – 15m wide sand bars are also identified within the Heda Oya stream path.
14	Sasthraveli Village	314958E 176646N	Metal Quarry	Coarse grained Charnockitic Gneiss; Existing metal quarry and the quarrying materials are being used for development work of Pothuvil – Panama main road. Crusher plant has also been established next to the quarry site. Workable area; Length – 75m, Width – 180m Height – 10m. GPS point is taken at the centre point of the quarry site. Workable
15	Sasthraveli Village	313719E 176102N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure identified in either side of the Pothuvil - Panama main road. Already mined pits have

				not been filled. Mining was conducted in an unsystematic manner. GPS point is taken at the centre point of gravel mined area.
16	Panama North	316125E 173950N	Mineral Sand	Northern boundary zone of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
16a	Panama North	315415E 172995N	Mineral Sand	One of the center point of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
16b	Panama North	313975E 171075N	Mineral Sand	One of the center point of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
16c	Panama North	313450E 170175N	Mineral Sand	Southern boundary zone of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
17	By the side of the Panama – Pothuvil main road	317396E 175623N	Metal Quarry	Pink Granitic Gneiss; Abandoned quarry; Potential to re-commence mining activities under IML – C category; Workable Area Length – 70m, Width – 60m Height – 15m. GPS point is taken at the centre point of the quarry site.
18	Sengamuwa	311388E 187777N	Construction Sand (River Sand)	Economically viable sand occurrences are observed within the stream bed and in both stream banks of Karanda Oya stream.
19	In right hand side of Pothuvil – Siyambalanduwa main road	308341E 186194N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure identified in right hand side of the Pothuvil - Siyambalanduwa main road. Gravel beds are extended in about 200m long and 100m wide area. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.

				GPS point is taken at the centre point of gravel mined area.
20	Komari	320300E 202711N	Metal Quarry	Massive Charnockite; Existing quarry; Quarrying materials are being used for development work of Pothuwil – Akkarapattu main road; This is an ideal rock for road construction work. A crusher plant is also established at the quarry site to crush blasted rock materials. GPS point is taken at the centre point of the quarry site.
21	South of Kunukala Lagoon	312475E 166725N	Mineral Sand	Northern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in south of Kunukala Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
21a	South of Kunukala Lagoon	311150E 165000N	Mineral Sand	Southern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in south of Kunukala Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
22	Coastal plain between Panakala and Salambe Lagoons	313700E 169250N	Mineral Sand	Northern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in south of Panakala Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
22a	Coastal plain between Panakala and Salambe Lagoons	313480E 168775N	Mineral Sand	Southern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in north of Salambe Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
23	Ulpassewewa	313000E 175850N	Metal Quarry	Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities.
24	Near Talawa	313850E 177150N	Metal Quarry	Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities.
25	Pansalgoda	305750E 186750N	Metal Quarry	Biotite Gneiss; Abandoned quarry; Potential to recommence mining activities.
26	Kottevehera	308150E 185850N	Metal Quarry	Biotite Gneiss; Abandoned quarry; Potential to recommence mining activities.
27	South of Komari	318800E 1195650N	Metal Quarry	Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities.

ANNEX IV

Identified Mineral Occurrences (category wise) within NECCDEP Zone Covering Trincomalee District

No.	Topo Sheet	Village	GPS Co-ordinates	Mineral / Rock	Remarks
1		Challimunar	234226E 404969N	Mineral sand	Spreads for 200 m distance along the coast. GPS point is centre point
2		Southern end of Kokilai Lagoon (northern end of Pulmoddai mineral sand deposit)	221234E 419469N	Mineral Sand	Northern boundary zone of Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd. Mineral sand occurrences are extended for nearly 100-150m width in beach plain.
3		Pulmoddai	221863E 418380N	Mineral Sand	Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd. Mineral sand occurrences are extended for nearly 100-150m width in beach plain
4		Pulmoddai	223262E 416475N	Mineral Sand	Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd. Mineral sand occurrences are extended for nearly 100-150m width in beach plain
5		Southern end of Pulmoddai mineral sand deposit	225210E 414025N	Mineral Sand	Southern boundary zone of Pulmuddai mineral sand mining area by Lanka Mineral Sand Ltd. Mineral sand occurrences are extended for nearly 100-150m width in beach plain
6		Kalarawa	227400E 410300N	Mineral Sand	Northern boundary zone of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain.
7		Kuchchaveli	235800E 401500N	Mineral Sand	Kuchchaveli sand body. Mineral sand occurrences are extended for nearly 75-100m width in beach plain.
8		Periakarachchi	240750E 395300N 240000E 395800N	Mineral Sand	Southern boundary zone of Periyakarachchi mineral sand body. Mineral sand occurrences are extended for nearly 100-500m width in beach plain. Northern boundary zone of Periyakarachchi mineral sand body. Mineral sand occurrences are extended for nearly 100-500m width in beach plain.
9		Alankerny	246002E 365402N	Mineral Sand	Garnet rich black mineral sands are mainly concentrated within the berm zone of beach in the Kinniya – Mutur road. In this

			(western boundary)		stretch, mineral sand could be mined by scraping the beach zone upto 0.3m depth.
10		Alankerny	246421E 363825N (eastern boundary)	Mineral Sand	Garnet rich black mineral sands are mainly concentrated within the berm zone of beach in the Kinniya – Mutur road. In this stretch. In this stretch, mineral sand could be mined by scraping the beach zone upto 0.3m depth.
11		Palchenai	271325E 333395N	Mineral Sand	Southern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
12		North of Verugal Aru Mouth	268725E 342571N	Mineral Sand	Northern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
13		North of Lankapatuna	267743E 350629N	Mineral Sand	Southern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
14		Uppural	266203E 354807N	Mineral Sand	Northern boundary zone of mineral sand occurrences along the coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain.
15		Koduwakattu	232100E 405450N 230000E 407000N 228450E 408650N	Mineral Sand	Southern boundary zone of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain. Middle section of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain. Middle section of Koduwakattu – Kalarawa mineral sand body. Mineral sand occurrences are extended for nearly 500-700m width in beach plain.
16		Wadalikulam	234871E 401442N	Metal Quarry	Massive charnockite; Existing quarry; Good for road construction work; Workable length – 300m, width – 30m & height – 20m; Scattered rock outcrops occur in the ridge.
17		Salapa Aru	237880E 397094N	Metal Quarry	Pink Granitic Gneiss. No. of abandoned quarries were identified along nearly 1km long ridge structure in its Eastern slope. Mining activities were terminated due to LTTE activities. Recommended

					for few IML-B category quarry projects. GPS point is centre point. Workable length – 50m, width – 30m & height – 20m.
18			226168E 409323N	Metal Quarry	Pink Granitic Gneiss; Potential quarry location; Strike ridge structure covered by secondary vegetation. Workable length – 300m, width – 30m & height – 15m.
19			226223E 404265N	Metal Quarry	Pink Granitic Gneiss; Abandoned quarry. But potential location to re-commence quarrying activities; Workable length – 50m, width – 25m & height – 15m.
20		Kallanpathai	225810E 403740N	Metal Quarry	Pink Granitic Gneiss; New potential location to commence quarrying activities; Workable length – 300m, width – 50m & height – 25-30m.
21		Varadikulam	234648E 401211N	Metal Quarry	Charnockitic Biotite Gneiss; Abandoned quarry; Potential to re-commence mining activities under IML – C category; Workable length – 75m, width – 30m & height – 8m.
22		Andankulam	245490E 377083N	Metal Quarry	Pink Granitic Gneiss; Existing quarry; Workable length – 100m, width – 25m & height – 25m.
23		Andankulam	245333E 377100N	Metal Quarry	Charnockitic Gneiss with metre scale inter banded granitic gneiss layers; Existing large quarry; This quarry is located in western slope of ridge structure where location 27 quarry is situated. In addition, several quarries are encountered in both slopes of this ridge; Workable area in this entire ridge structure is 400m long, 50m wide and 25m high.
24		Seruwila New Temple Road	260215E 347588N	Metal Quarry	Pink Granitic Gneiss; Existing minor quarry; Scattered outcrop with boulders; About 6 persons are involving mining activities of this rock at different places; Workable area of entire rock is as follows length – 300m, width – 35m & height – 15m. GPS is taken in the centre point of quarrying area.
25		Kawantissapura Seruwila New Temple Road	260144E 349163N	Metal Quarry	Charnockitic Biotite Gneiss; Existing minor quarry; Small outcrop; Workable length – 30m, width – 15m & height – 5m. GPS is taken in the centre point of quarrying area.
26		Mawadichenai	266351E 340060N	Metal Quarry	Pink Hornblende Granitic Gneiss; New potential quarry site for operating IML – C category quarry. Workable length – 150m, width – 35m & height – 15m. GPS is taken in the centre point.
27		Verugal	265910E 339075N	Metal Quarry	Pink Hornblende Granitic Gneiss; New potential quarry site for operating IML – C category quarry. Workable length – 100m,

					width – 20m & height – 15m. GPS is taken in the centre point.
28		Kuchchaweli	235585E 401418N	Ground Water	Both sides of the road around Kuchchaweli town limits, good ground water bearing area exists. Sandy Aquifer
29		Salapa Aru Tsunami Village	238185E 397187N	Ground Water	Good ground water bearing area. Sandy Aquifer. Using 3 dug wells, water is pumped for 200 houses
30		Kumburupiddi	242058E 393014N	Ground Water	Both sides of the road around Kumburupiddi village, potential ground water bearing area exists for more than 1km distance along the road. Sandy Aquifer; Presently, ground water in this area is being pumped by constructing number of agricultural wells.
31		Periyakarachchi	240176E 394755N	Proposed Saltern	Proposed Saltern in 1805 acre area in the lagoon. GPS point is centre point
32		Nilaweli	245813E 385629N	Abandoned Saltern	Nilaweli saltern abandoned in eighties. Potential site for re-commencing the industry. GPS point is centre point.
33		Munaichenai	243840E 364204N	Existing Saltern	Seasonal saltern is located in both sides of the Kinniya – Thambalagamuwa main road, near 11th km post. It is owned by several private personnel. During maha season, saltern is not functioned due to its high water table. GPS point is centre point of saltern, on the road
34		Kachchakoditivu	243102E 363614N	Existing Saltern	Seasonal saltern is located in right hand side of the Kinniya – Thambalagamuwa main road, in front of Kinniya Pradeshiya Sabha between 11th and 12th km posts. It is owned by several private personnel. During maha season, saltern is not functioned due to its high water table. GPS point is taken from the boundary zone of saltern at the Kinniya – Thambalagamuwa main road.
35		Siri Mangalapura	253355E 343853N	Brick Clay	In this area, brick clay occurrences are identified in about 100 – 200 acre land. The entire area is appeared to be an ancient flood plain (possibly ancient flood plain of Mahaweli River). Its thickness is about 1-1.5m. Nearly 100 families are engaged in brick manufacturing industry by mining this clay bed. The entire land belongs to the Forest Department.
36		Punagar near Echchalampattu	263055E 342341N	Brick Clay	In this area, brick clay occurrences are identified in about 50 acre land. Its thickness is about 1-5m. Brick manufacturing industry is largely taken in the area by mining this clay bed.
37		Pulmoddai	223659E 415640N	Construction Sand	After refining mineral sands, remaining sands were piled up for nearly 100m long, 50m wide & 10-12m high and 125m long, 50m

					wide & 12-14m high two sections within the LMS Ltd premises. These sands could be used for construction activities. GPS point is northern end of sand piled up area.
			226139E 404656N	Construction Sand (River Sand)	Existing sand mining location in a stream. This place is good for artisanal mining.
39		Neelapola	248955E 352672N	Construction Sand (River Sand)	Large scale sand mining activities are conducted in Neelapola area in the right bank of the Mahaweli river, within the Wildlife Sanctuary. Sand mining activities are limited to the right bank of the river.
40		Wellanaval	248955E 352672N	Construction Sand (River Sand)	Medium scale sand mining activities are conducted in Wellanaval area in the right bank of the Mahaweli river, within the Wildlife Sanctuary. Sand mining location could only be reached by a boat and is about 4km away from the sand stockpiling area at Ralkuddi. Mined sand are transported to Ralkuddi area near west of Mutur by boats.
41		Mawadichenai	264290E 339722N	Construction Sand (River Sand)	Construction sand mining activities are conducting on large scale from the Verugal Aru stream bed and stream banks. In the right bank of the river, sharp bend is observed and large sand bar has formed at this location. Workable length – 500m, width – 100m & height – 1.5m. GPS is taken in the centre point of mining area.
42		Siri Mangalapura	252920E 343922N	Construction Sand (Land Based Sand in ancient River Course))	Below the 1-1.5m thick brick clay bed at Sri Mangalapura area (refer loc. No. 40), about 4-6m thick sand occurrences are encountered. Few years back, some outsiders started mining these land based sand occurrences. But, due to strong opposition of villagers they had to abandon the mining activities.
43		Bogaspitiya	244448E 347433N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
44		Bogaspitiya	244604E 347623N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
45		Kinniyapitiya	245343E 347866N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale

46		Kinniyapitiya	245754E 347988N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
47		Kotiyapitiya	244836E 347687N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
48		Kotiyapitiya	245258E 347747N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
49		Sunken Lanka	243829E 346887N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
50		Sunken Lanka	244477E 347326N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
51		South of Sunken Lanka	244031E 346384N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
52		South of Sunken Lanka	243946E 346558N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
53		East Kinniyapitiya of	245767E 347803N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
54		East Kinniyapitiya of	246111E 347737N	Construction Sand (River Sand)	Sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
55		West Kinniyapitiya of	246011E 347855N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
56		West Kinniyapitiya of	246172E 348014N	Construction Sand (River Sand)	New potential location for sand mining in Mahaweli River. North of Siththaru Bridge near Kantale
57		Kanniya	221450E 386550N	Hot Water Springs	Hot water springs are located in Kanniya, near Trincomalee; Average temperature of these hot water wells is 420C; Total of

					<p>five wells are located adjacent to each other; All these hot springs smell characteristic hydrogen sulphide gas and they have been developed by Kanniya Pradeshiya Sabha for spa / hot water bathing for tourists.</p> <p>Detailed investigations are needed to check the possibility of use of hot water springs for power generation. Utilization of hot dry rock geothermal energy is another option that needs to be investigated.</p> <p>GPS is taken in the centre point of hot water springs.</p>
58		Illandeikulam	227559E 402261N	Gravel Pits	<p>Light yellowish brown colour gravel materials originated by weathering of granitic gneiss rock; Large numbers of abandoned gravel mined pits are encountered in about 200m x 150m size land area. In this area unsystematic mining was conducted in about 2-5m below the ground surface. None of the mined pits were rehabilitated and as result water stagnating is observed. This feature is a severe environmental hazard of the area. It is proposed to rehabilitate the mined pits by converting them to a tank and thereby fresh water fish breeding could be done. GPS point is centre point.</p>
59			229014E 401732N	Gravel Pits	<p>Reddish brown quartzitic gravel; Good for road surfacing; Numbers of abandoned gravel mined pits are encountered in about 100m x 50m size land area. In this area mining was conducted in about 1.5-2m below the ground surface. This area is recommended for further gravel mining in systematic manner; So far, none of the mined pits were rehabilitated and it is proposed to fill them by using overburden materials, after mining is completed. GPS point is centre point.</p>
60			247043E 381131N	Gravel Pits	<p>Reddish brown quartzitic gravel; Good for road surfacing; Large number of abandoned and working gravel pits are encountered within the weathered overburden cover of about 10 – 12m high quartzite strike ridge structure which is trending in 045°/75° direction for about 1.5 – 2 km distance. In both sides of the ridge structure, large numbers of gravel pits are identified.</p>

					GPS point is taken at the crossing point of quartzite ridge structure with Nilaweli – Trincomalee road.
61			248328E 378585N	Gravel Pits	<p>Reddish brown quartzitic gravel; Good for road surfacing; Large number of abandoned and working gravel pits are encountered within the weathered overburden cover of about 08 – 10m high quartzite strike ridge structure which is trending in 070°/80° direction for several km distances. In both sides of the ridge structure, large numbers of gravel pits are identified. However due to presence of houses, gravel pits in SE slope of the ridge is limited.</p> <p>GPS point is taken at the crossing point of quartzite ridge structure with Nilaweli – Trincomalee road.</p>
62			246961E 376061N	Gravel Pit	Reddish brown quartzitic gravel; Good for road surfacing; Gravel pit is located near to the Trincomalee – Anuradhapura main road. Considering its close proximity to the main road, it is recommended to re-commence mining activities. Existing size of the pit is 40m in length and 5m in height. However, gravel bearing ridge is continuing for several hundred metres parallel to the main road. Gravel could be mined from both sides of the ridge
63		Trincomalee Technical College Premises	247088E 375973N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Gravel pit is located near to the Trincomalee – Anuradhapura main road (in Technical College premises) Quartzite ridge is extending in either side of the road (ridge is trending perpendicular to the main road) Due to the presence of Technical college and number of houses within the ridge, only selective mining could be done at pre-identified locations.
64		Anuradhapura – Trincomalee road	244571E 377583N	Gravel Pits	Reddish brown quartzitic gravel; Good for road surfacing; Number of gravel pits are located in the eastern slope of the quartzite ridge structure which is extending for few km distance; Towards further southern direction, no existing gravel pits are identified. However, it is possible to open up number of gravel pits in this section. This ridge is crossing the Trincomalee – Anuradhapura main road and the ridge is trending in perpendicular to the road.

65		Within the Air Force Base in Trincomalee (along the Kinniya – China Bay road)	246174E 369903N	Gravel Pit	Reddish brown weathered quartzitic overburden materials are encountered in the quartzite band located within the Air Force base premises, parallel to the Kinniya – China Bay main road.
66		Nachchikudah	245571E 368503N	Gravel Pit	Reddish brown weathered quartzitic overburden materials are encountered at the bottom of quartzite band located opposite the Thambalagam Bay in Kinniya – China Bay main road. Presently, gravel is being mined from this location
67		Seruwila	259819E 345962N	Cu – Fe Deposit	Seruwila Cu-Fe body is centred on this location. It occurs as a series of lenticular pods arranged along the regional strike and is spread over an area of nearly 10 square kilometres. Its mineralization, mainly magnetite and copper minerals – chalcopyrite, bornite, malachite and azurite, etc., is restricted to basic metamorphic rocks. It occurs in three discrete blocks, namely, Arippu, Block – B and Kollankulam Blocks.

ANNEX – V

Identified Mineral Occurrences (category wise) within NECCDEP Zone Covering Batticaloa District

No.	Topo sheet	Village	GPS Co-ordinates	Mineral / Rock	Remarks
1		Verugal	266122E 337633N	Metal Quarry	Hornblende Biotite Migmatitic Gneiss; Abandoned quarry; Abandoned due to presence of Archaeological Importance Features on the top of rock exposure. However, massive crushing plant is located at this quarry site to crush rock materials bringing down from location no. 2.
2		Kathiraveli	266749E 334869N	Metal Quarry	Grayish Colour Granitic Gneiss; Existing quarry belongs to China Harbour Engineering Company; At this place rock blasting and breaking is taken place and Blasted and broken rock materials are transported to crusher plant located at Verugal (location no. 1) for crushing; Rock materials are used for development work of Vakarai – Varugal stretch of Batticaloa – Trincomalee road (A 15).
3		Mullivattavan in Vakaneri	272667E 302110N	Metal Quarry	Migmatitic Gneiss; New potential location to commence quarrying activities; The entire outcrop is exposed in about 1 square kilometer area. Of this amount, nearly half is boarding the Vakaneri Tank. Hence, not recommended for mining. Of the balance half, the southernmost section is exposed up to 10m from the ground level and is located few hundred metres away from the tank. Hence it is possible to mine. GPS point is taken at the centre point of gravel bearing section.
4		Kusalanagama	282249E 278834N	Metal Quarry	Hornblende bearing Pink Granitic Gneiss; Existing quarry; Quarry materials is being used for development work of Chenkalady – Maha Oya main road by a private party. Crusher plant is also available about 300 - 400m away from the quarry site; Workable length – 75m, width – 40m and height – 15m. A large rock exposure is observed in close proximity to this quarry site. But due to presence of Archaeological features, the rock cannot be mined.

					GPS point is taken at the centre point of the quarry site
5		Kuchchaweli	266906E 334783N	Gravel Pits	Light brown colour gravel materials originated by weathering of granitic gneiss rock are currently being mined; These gravel pits are located next to the existing quarry at location no. 2 in its eastern direction. It was noted that section of mined pits had already been filled. The mined gravel is being used for road surfacing. However, it is necessary to check the suitability of mined gravel for road surfacing activities, as the mined gravel from this area is appeared to be low in quality.
6			273554E 315267N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered within a 200m long, 75m wide and 3m deep section; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 5m high small ridge structure. Already mined pits have not been filled. GPS point is taken at the centre point of gravel bearing section.
7		Near 124km post of Polonnaruwa – Trikonamadu main road	276493E 304734N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered within a 500m long, 100m wide and 2m deep section in both sides of Polonnaruwa – Trikonamadu main road; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 6m high small ridge structure. Already mined pits have not been filled. GPS point is taken at the centre point of gravel bearing section.
8		At 279km post of Chenkalady – Maha Oya main road	287721E 283455N	Gravel Pit	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in both sides of the main road; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 2 - 4m high small ridge structure. Already mined pits have not been filled. GPS point is taken at the crossing point of gravel bearing area with Chenkalady – Maha Oya main road.
9		Mullivattavan in	268917E	Construction	Existing river sand mining location in Maduru Oya river bed and

		Vakaneri	303798N	Sand (River Sand)	flood plain; In this location, medium to course grained good quality sand bar is encountered in nearly 400m long, 30m wide and 1.5m high section. GPS point is taken at the centre point of sand bearing area.
10		Palchenai	284311E 280002N	Construction Sand (Manufactured Sand)	Quartzite ridge; Weathered overburden materials of this quartzite ridge have already been mined to get gravel for road surfacing; Currently, only quartzite rock is available at this location and is extended as few hundred metres long, nearly 40m wide and 7 – 10m high strike ridge structure. The entire ridge is situated in an isolated location; No human settlements are observed at the vicinity of this quartzite ridge structure and it is covered by paddy fields; It is possible to use quartzite rock materials of this ridge structure for preparation of manufactured sand by crushing. GPS point is taken at the crossing point of quartzite ridge structure with Iluppadichchenai - Toppigala road.
11		Mavadi Odai	280650E 279600N	Construction Sand (River Sand)	Currently, sand is mined from the river bed and both banks of Mavadi Odai stream, about 500m upstream of Mavadi Odai bridge along Iluppadichchenai - Toppigala road; At this location, medium to course grained good quality sand is observed. GPS point is taken at the centre point of sand bearing area.
12		Mavadi Odai	280850E 279900N	Construction Sand (River Sand)	Currently, sand is mined from the river bed of Mavadi Odai branch stream. The Mavadi Odai branch stream is located about 100m west of Mavadi Odai main stream, along Iluppadichchenai - Toppigala road; At this location, medium to course grained good quality sand is mined from the river bed and its both banks. GPS point is taken at the centre point of sand bearing area.
13		Palamadu	281700E 284085N	Construction Sand (River Sand)	Existing sand mining location in Levaru Aru stream; Considerable amount of sand is mined from the sand bar in the river bed and in both banks. The mined sand is transported to stockpiling area located about 500m away. GPS co-ordinates of stock piling area are 281527E / 283652N).

14		Nellupodiyagal	287481E 282502N	Brick Clay	<p>Deep red clay bed; Good for manufacture of bricks; It occurs as 1.5m thick bed, bordering paddy field. After mining, the land could be converted to a paddy field. The clay bed is extended for 400m long and 200m wide area.</p> <p>GPS point is taken at the centre point of clay bearing area.</p>
15		Muhathuwaram in Batticaloa Lagoon	302375E 282225N	Shell Beds	<p>Northern boundary zone of shells collected area; Shells are collected by hand picking in Muhathuwaram area in Batticaloa Lagoon; These activities are conducted in cottage level.</p> <p>GPS point is taken at the centre point of lime burning industry prevailing area.</p>
16		Navaladi in Batticaloa Lagoon	302725E 281225N	Shell Beds	<p>Southern boundary zone of shells collected area; Shells are collected by hand picking in Navaladi in Batticaloa Lagoon; These activities are conducted in cottage level.</p> <p>GPS point is taken at the centre point of lime burning industry prevailing area.</p>
17		Arayampathy	306667E 273112N	Lime Burning Industry	<p>Lime burning industry is conducted in cottage level in Arayampathy area, near 419km post of A4 main road; Number of families is engaged in this industry; Shells mined from Muhathuwaram in Navaladi in Batticaloa Lagoon are used as raw materials for lime burning industry at this location.</p>
18		Thalamkudah	307556E 271707N	Glass Sand	<p>White sand occurrences which are suitable for manufacture of glass products are identified in Thalamkudah area; These white sand occurrences are extended in nearly 750m wide coastal stretch for about 250 width. Most section of the glass sand occurrence is occurred in government owned land area.</p> <p>During field investigations it was observed that part of the glass sand bearing area (close proximity to the A4 main road) is being blocked out for some reasons, possibly for human settlements. Therefore, it is highly recommended to reserve the area covered by glass sand occurrences so that glass manufacturing industry could be commenced in the area in near future.</p>

					GPS point is taken at the centre point of white sand occurrences.
19		Thalamkudah	307556E 271707N	Ground Water	Good ground water bearing area. Sandy Aquifer. WT is 1.8m. Dwellers use dug wells.
20		Kirankulam	309900E 267000N (7°36'39" N 81° 45'51" E)	Ground Water	Sandy Aquifer. WT is 0.45m. Dwellers use dug wells for agricultural purposes.
21		Kaluthavalai	312000E 258500N (7°31'54" N 81° 47'55" E)	Ground Water	Sandy Aquifer. WT is 1.5m. Use agro wells for agricultural purposes.
22		Marnkerni	279043E 312015N	Mineral Sand	Northern boundary zone of black mineral sand rich area along the coast; Black sand concentration is rich in both tidal and berm area; Black sands are extended in nearly 40m wide stretch in landward direction.
23		Keelikudah	280987E 310288N	Mineral Sand	Southern boundary zone of black mineral sand rich area along the coast; Black sand concentration is rich in both tidal and berm area; Black sands are extended in nearly 40m wide stretch in landward direction.

ANNEX - VI

Identified Mineral Occurrences (category wise) within NECCDEP Zone Covering Ampara District

No.	Topo Sheet	Village	GPS Co-ordinates	Mineral / Rock	Remarks
1		Kallodai Aru in Oluvil	317394E 232342N (eastern boundary zone of sand mining area in Kallodai Aru	Construction Sand (River Sand)	Eastern boundary zone of sand mining area of Kallodai Aru stream within the study area. Sand is mined from river bed and in both banks of Kallodai Aru stream. In this stream, exposed sand bars are also identified at places. They too could be mined. Parallel to Oluvil – Deegawapi road, Kallodai Aru stream exists in W – E direction.
2		Kallodai Aru in Oluvil	316430E 232194N (western boundary zone of sand mining area in Kallodai Aru	Construction Sand (River Sand)	Western boundary zone of sand mining area of Kallodai Aru stream within the study area. Sand is mined from river bed and in both banks of Kallodai Aru stream. In this stream, exposed sand bars are also identified at places. They too could be mined. Parallel to Oluvil – Deegawapi road, Kallodai Aru stream exists in W – E direction.
3		Neethai Aru in Akkaraipattu – Sagama road	314808E 218405N	Construction Sand (River Sand)	River sand mining could be commenced in river bed and in both stream banks of the Neethai Aru stream. It is recommended to commence sand mining activities in about 250m upstream from the bridge across Neethai Aru stream along Akkaraipattu – Sagama road. The 250m distance is selected by considering the relatively small size of the stream GPS point is taken at the eastern boundary zone of proposed sand mining area.
4		Telipola Aru in Akkaraipattu – Sagama road	313204E 214806N	Construction Sand (River Sand)	River sand mining could be commenced in river bed and in both stream banks of the Telipola Aru stream. It is recommended to commence sand mining activities in about 250m upstream from the bridge across Telipola Aru stream along Akkaraipattu – Sagama road. The 250m distance is selected by considering the relatively small size of the stream GPS point is taken at the eastern boundary zone of proposed sand mining area.

5		Yamanthurai, Nawalur	313750E 180000N	Construction Sand (River Sand)	Eastern boundary zone of river sand mining area in Heda Oya at Yamanthurai in Nawalur. Beyond 500m upstream from the bridge across Heda Oya along the Pothuvil – Panama main road, river sand could be mined from stream bed and in both flood plains. Few metres high, several tenths of metres long and 10 – 15m wide sand bars are also identified within the Heda Oya stream path.
6		Yamanthurai, Nawalur	312260E 180215N	Construction Sand (River Sand)	Western boundary zone of river sand mining area in Heda Oya at Yamanthurai in Nawalur. River sand could be mined from stream bed and in both flood plains. Few metres high, several tenths of metres long and 10 – 15m wide sand bars are also identified within the Heda Oya stream path.
7		Sengamuwa	311388E 187777N	Construction Sand (River Sand)	Economically viable sand occurrences are observed within the stream bed and in both stream banks of Karanda Oya stream.
8		Oluvil – Deegawapi road	315027E 231986N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned and working gravel pits are encountered within a 300m long, 100m wide and upto 3m deep section; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 5m high small ridge structure. Already mined pits have not been filled. Current mining is conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel bearing section.</p>
9		Oluvil – Deegawapi road (near Deegawapi)	314249E 231819N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered within a 350m long, 150m wide and upto 3m deep section; Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 4 - 5m high small ridge structure. Already mined pits have not been filled. . Current mining is conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel bearing section.</p>
10			315646E 210744N	Gravel Pits	Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area.

					<p>Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel mined area.</p>
11			317078E 210602N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in either side of the Akkaraipattu – Pothuvil main road. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel mined area.</p>
12		Sangamankanda	320096E 200487N	Gravel Pits	<p>Reddish brown lateritic soil cover is encountered as the overburden cover of 12 – 15m high ridge structure at Sangamankanda area; Below the lateritic soil cover, charnockite rock is observed; These lateritic soil cover is appeared to be formed as a result of lateritization process of charnockite rocks; Part of the lateritic soil cover has been mined to get gravel for road surfacing;</p> <p>This lateritic soil cover is extended for 5 – 6 acre area. The entire ridge is situated in an isolated location; No human settlements are observed at the vicinity of this lateritic soil cover; Considerable amount of gravel materials could be mined by further cutting of this lateritic overburden cover.</p> <p>GPS point is taken at the centre point of glass sand occurrences.</p>
13		Komari	320358E 197208N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high</p>

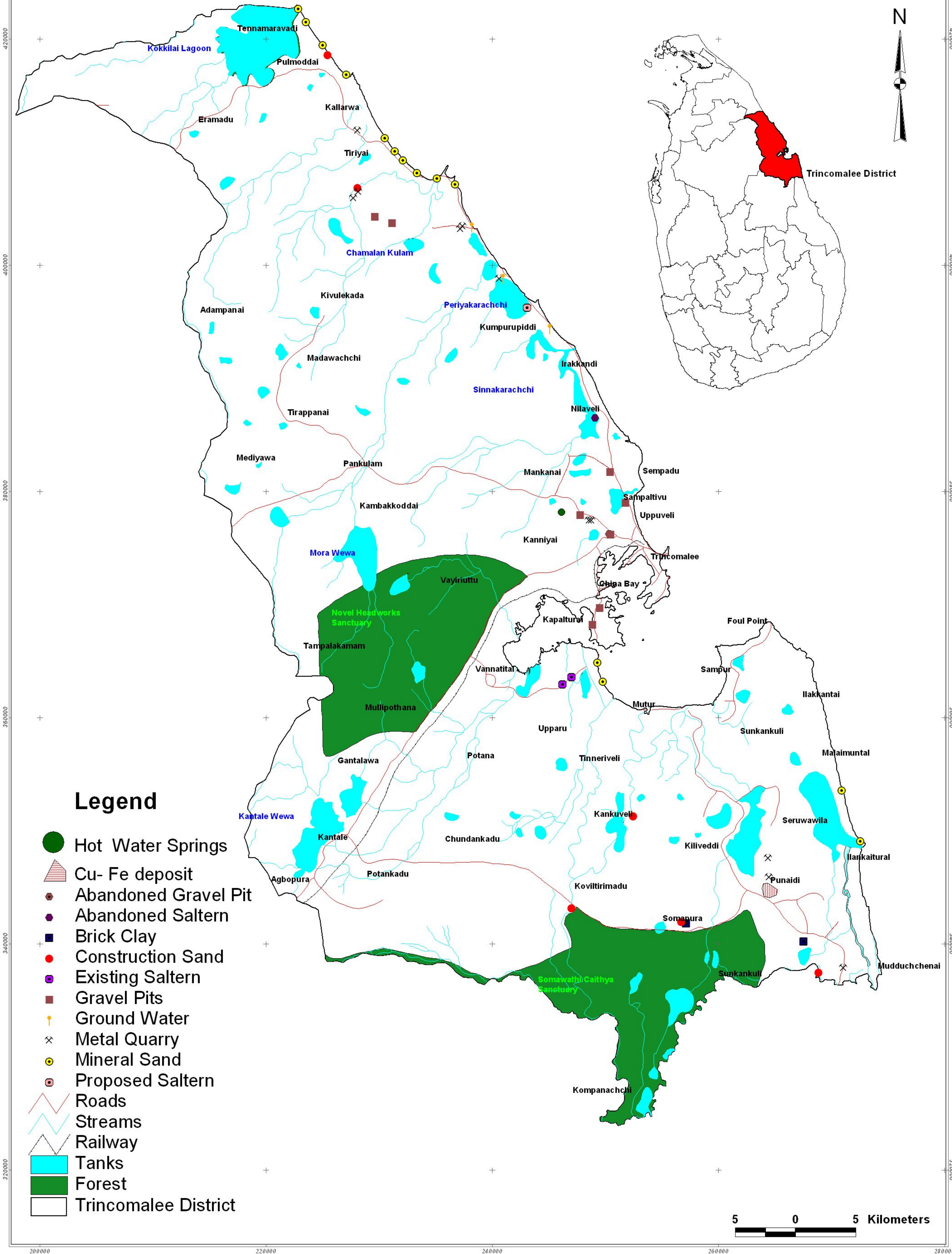
					<p>small ridge structure identified in either side of the Akkarapattu – Pothuvil main road. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel mined area.</p>
14		Sasthraveli Village	313719E 176102N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure identified in either side of the Pothuvil - Panama main road. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel mined area.</p>
15		In right hand side of Pothuvil – Siyambalanduwa main road	308341E 186194N	Gravel Pits	<p>Reddish brown pegmatitic gravel; Good for road surfacing; Number of abandoned gravel pits are encountered in the area. Considerable amount of further reserves are available for mining. The gravel bed is located in an isolated 3 - 4m high small ridge structure identified in right hand side of the Pothuvil - Siyambalanduwa main road. Gravel beds are extended in about 200m long and 100m wide area. Already mined pits have not been filled. Mining was conducted in an unsystematic manner.</p> <p>GPS point is taken at the centre point of gravel mined area.</p>
16		Kannakipuram	315627E 219868N	Metal Quarry	<p>Granitic Gneiss; Existing quarry; Workable area; Length – 75m, Width – 25m Height – 10m.</p> <p>Nearly 300m away from this quarry location, about 35 – 40m high large rock exposure is situated in SW direction. Two abandoned quarries are located within this rock exposure. Due to presence of number of nearby houses, both of these quarries had to be abandoned few years back.</p> <p>GPS point is taken at the western boundary of the quarry.</p>

17		Sasthraveli Village	314958E 176646N	Metal Quarry	Coarse grained Charnockitic Gneiss; Existing metal quarry and the quarrying materials are being used for development work of Pothuvil – Panama main road. Crusher plant has also been established next to the quarry site. Workable area; Length – 75m, Width – 180m Height – 10m. GPS point is taken at the centre point of the quarry site. Workable
18		By the side of the Panama – Pothuvil main road	317396E 175623N	Metal Quarry	Pink Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities under IML – C category; Workable Area Length – 70m, Width – 60m Height – 15m. GPS point is taken at the centre point of the quarry site.
19		Komari	320300E 202711N	Metal Quarry	Massive Charnockite; Existing quarry; Quarrying materials are being used for development work of Pothuvil – Akkarapattu main road; This is an ideal rock for road construction work. A crusher plant is also established at the quarry site to crush blasted rock materials. GPS point is taken at the centre point of the quarry site.
20		Ulpassewewa	313000E 175850N	Metal Quarry	Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities.
21		Near Talawa	313850E 177150N	Metal Quarry	Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities.
22		Pansalgoda	305750E 186750N	Metal Quarry	Biotite Gneiss; Abandoned quarry; Potential to recommence mining activities.
23		Kottevehera	308150E 185850N	Metal Quarry	Biotite Gneiss; Abandoned quarry; Potential to recommence mining activities.
24		South of Komari	318800E 1195650N	Metal Quarry	Granitic Gneiss; Abandoned quarry; Potential to recommence mining activities.
25		Thirukkovil	319993E 216559N	Mineral Sand	Northern boundary zone of mineral sand occurrences along the Thirukkovil coastal stretch. It is bounded by mouth of Periya Mottuwaran Lagoon. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone.

26		Thirukkovil	319819E 215572N	Mineral Sand	Inside point of mineral sand occurrences along the coastal stretch in Thirukkovil. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone
27		Thirukkovil	319701E 214553N	Mineral Sand	Inside point of mineral sand occurrences along the coastal stretch in Thirukkovil. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone
28		Thirukkovil	319691E 213986N	Mineral Sand	Southern boundary zone of mineral sand occurrences along the Thirukkovil coastal stretch. Mineral sand occurrences are extended for nearly 100m width in beach plain. Economical grade mineral sands occur in both tidal zone and in berm zone.
29		Panama North	316125E 173950N	Mineral Sand	Northern boundary zone of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
30		Panama North	315415E 172995N	Mineral Sand	One of the center point of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
31		Panama North	313975E 171075N	Mineral Sand	One of the center point of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
32		Panama North	313450E 170175N	Mineral Sand	Southern boundary zone of economically viable mineral sand occurrences within 6 – 8m high sand dunes in Panama North area. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
33		South of Kunukala Lagoon	312475E 166725N	Mineral Sand	Northern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in south of Kunukala Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
34		South of Kunukala Lagoon	311150E 165000N	Mineral Sand	Southern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in south of Kunukala Lagoon. In addition, economically viable mineral

					sands are also extended in the tidal and berm zones as well.
35		Coastal plain between Panakala and Salambe Lagoons	313700E 169250N	Mineral Sand	Northern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in south of Panakala Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
36		Coastal plain between Panakala and Salambe Lagoons	313480E 168775N	Mineral Sand	Southern boundary zone of economically viable mineral sand occurrences within 3 – 6m high sand dunes in north of Salambe Lagoon. In addition, economically viable mineral sands are also extended in the tidal and berm zones as well.
37		Manalchena	321247E 201361N	Glass Sand	White sand occurrences suitable for manufacturing of glass products are occurred in Manalchena area. These white sand occurrences are extended for few acres in extent. GPS point is taken at the centre point of glass sand occurrences.

Mineral Resources in Trincomalee District NECCDEP Area

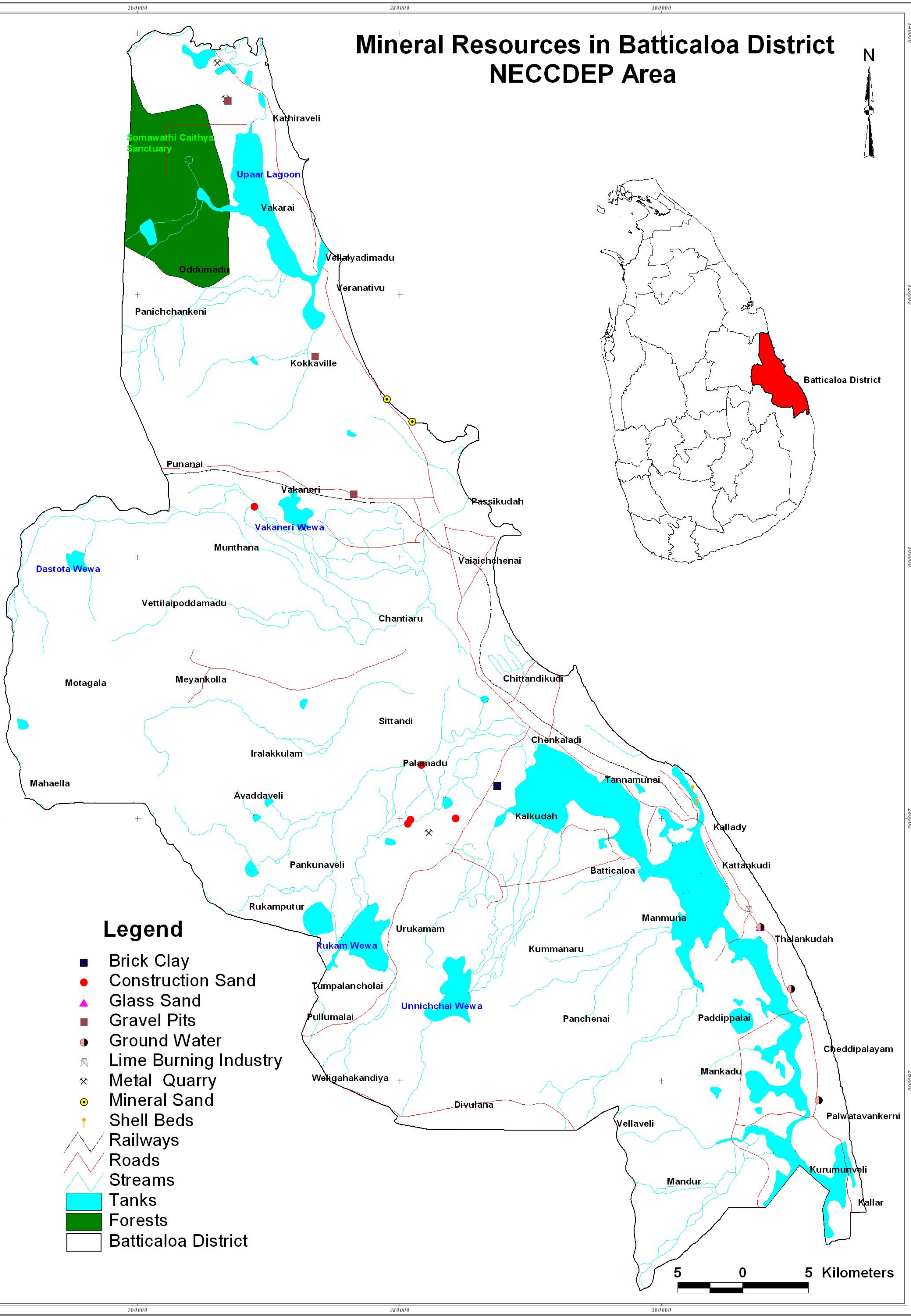
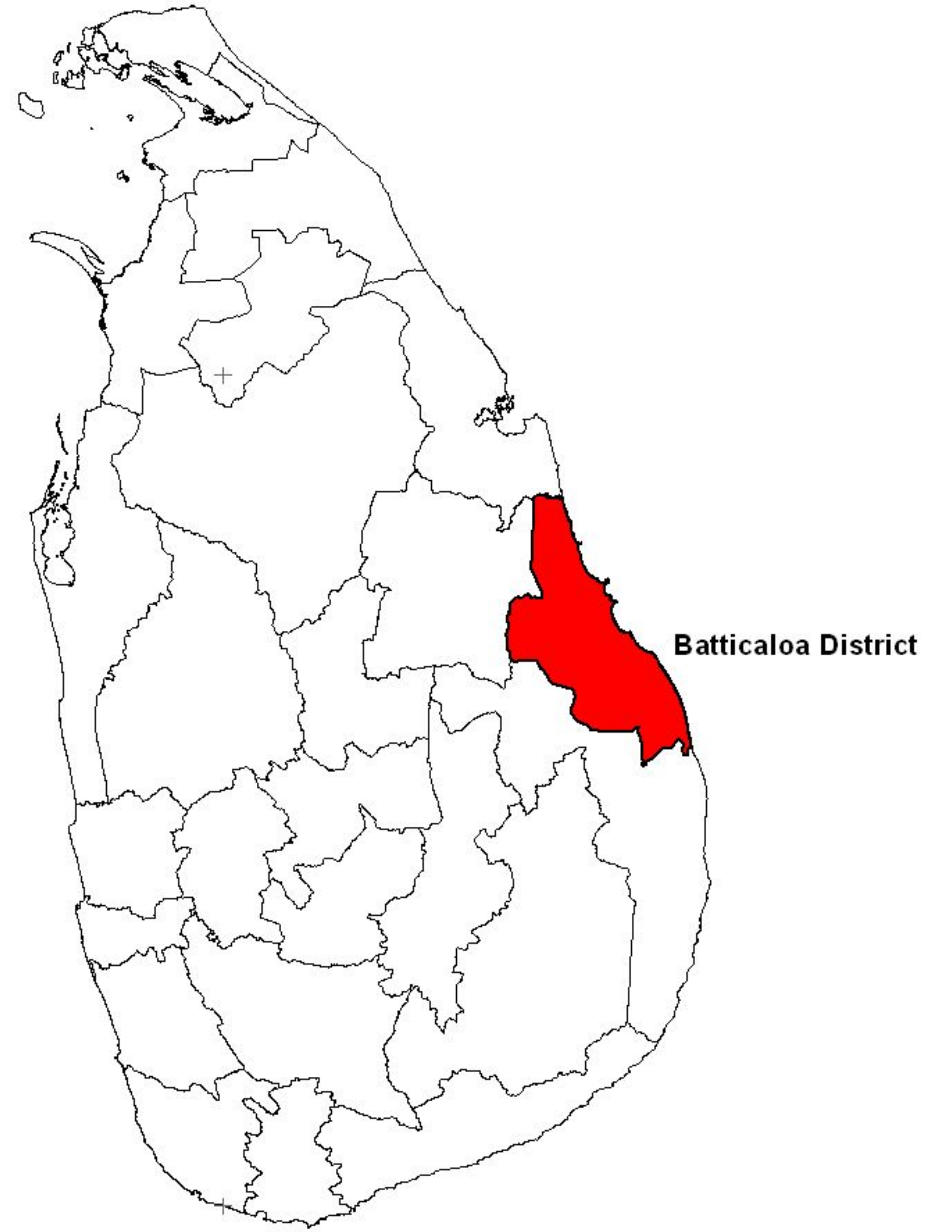


Legend

- Hot Water Springs
- ▲ Cu- Fe deposit
- Abandoned Gravel Pit
- Abandoned Saltern
- Brick Clay
- Construction Sand
- Existing Saltern
- Gravel Pits
- ↑ Ground Water
- × Metal Quarry
- Mineral Sand
- Proposed Saltern
- Roads
- Streams
- Railway
- Tanks
- Forest
- Trincomalee District

5 0 5 Kilometers

Mineral Resources in Batticaloa District NECCDEP Area



Legend

- Brick Clay
- Construction Sand
- ▲ Glass Sand
- Gravel Pits
- Ground Water
- ⊠ Lime Burning Industry
- ⊗ Metal Quarry
- Mineral Sand
- ↑ Shell Beds
- Railways
- Roads
- Streams
- Tanks
- Forests
- Batticaloa District

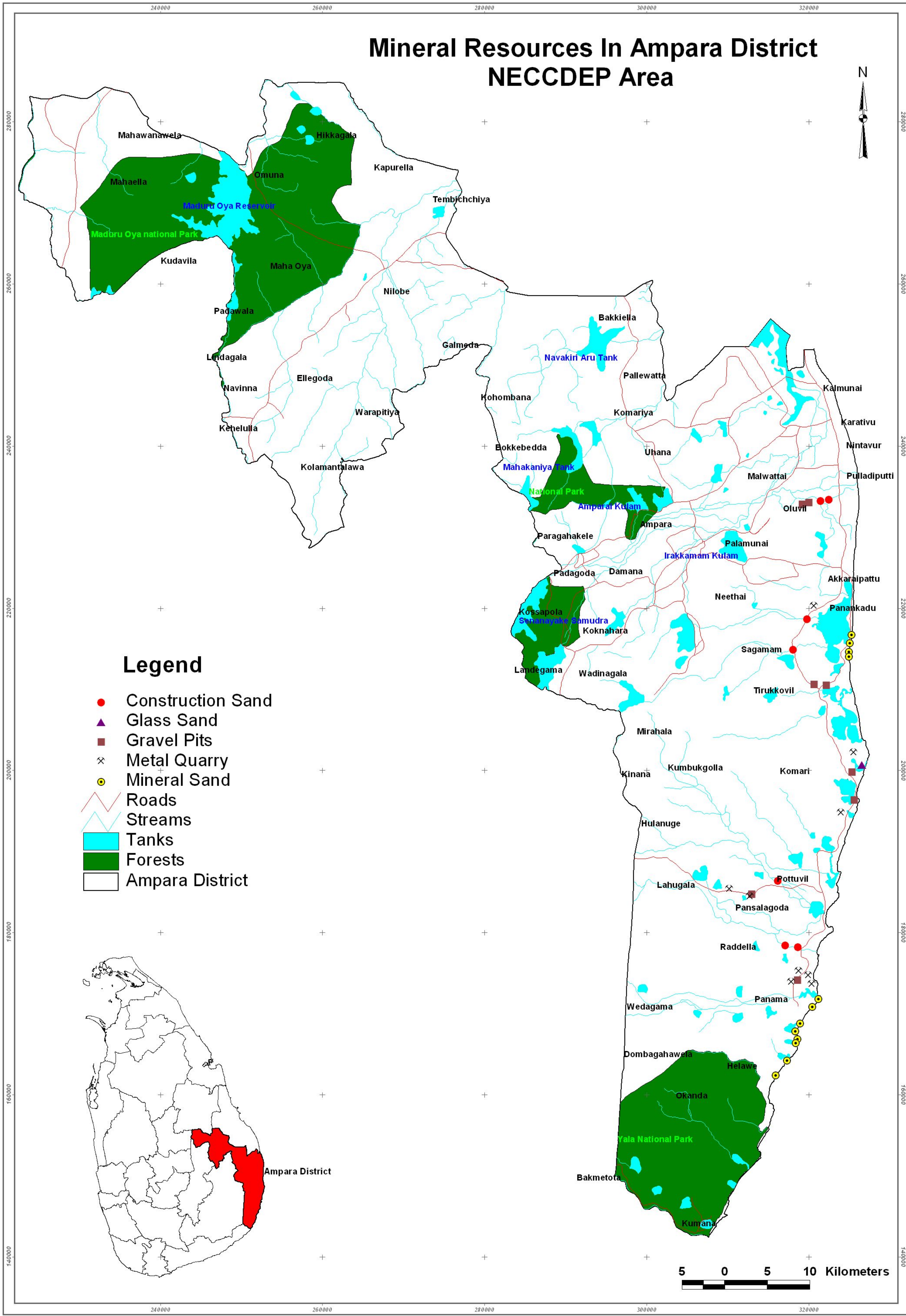
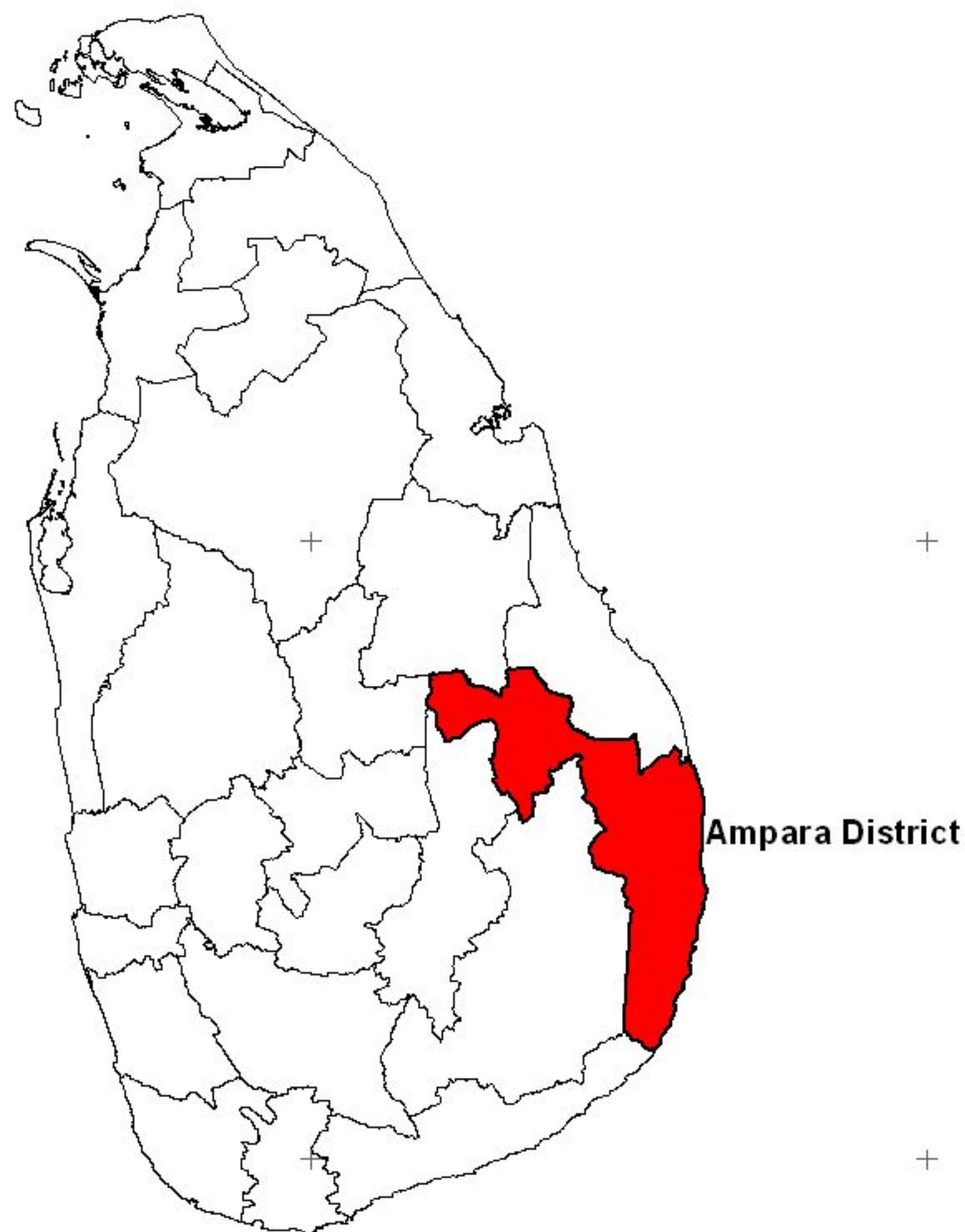


Mineral Resources In Ampara District NECCDEP Area



Legend

- Construction Sand
- ▲ Glass Sand
- Gravel Pits
- ⊗ Metal Quarry
- Mineral Sand
- Roads
- Streams
- Tanks
- Forests
- Ampara District



SUMMARY OF MINING PRODUCTION AND MARKETS

Production of Minerals

(Tonnes, unless otherwise specified)

Mineral Type	2005	2006	2007	2008
Ceramic Raw Material				
Kaolin	9,914	10914	11178	10039
Ball Clay	38873	61966	43004	52966
Feldspar	45492	56864	46583	55212
Vein quartz	24286	25539	35066	37196
Silica sand	37778	46070	69548	61291
Calcite	4344	5161	10069	6307
Construction Materials				
Limestone	971146	1094919	1094918	1091227
Dimension stone	3747	4117	3302	4498
Island coral	2246	5317	1370	-
Sea shells	1943	1162	10418	1231
River sand (m ³)	Na	Na	4000000	8200200
Sea sand (m ³)	Na	Na	367000	266136
Fertilizer Materials				
Dolomite	1,371,873	180,225	190,000	162,000*
Apatite	41,811	42,159	40,128	41,942
Other Minerals				
Graphite	5133	5756	9593	6615
Mica	1800	2600	3224	2,364
Salt	67,029	87,560	70,209	110,856
Gypsum	66	548	-	617
Gems (carats)	5,234,640	8,931,696	7,458,700	7,531,400

* estimated

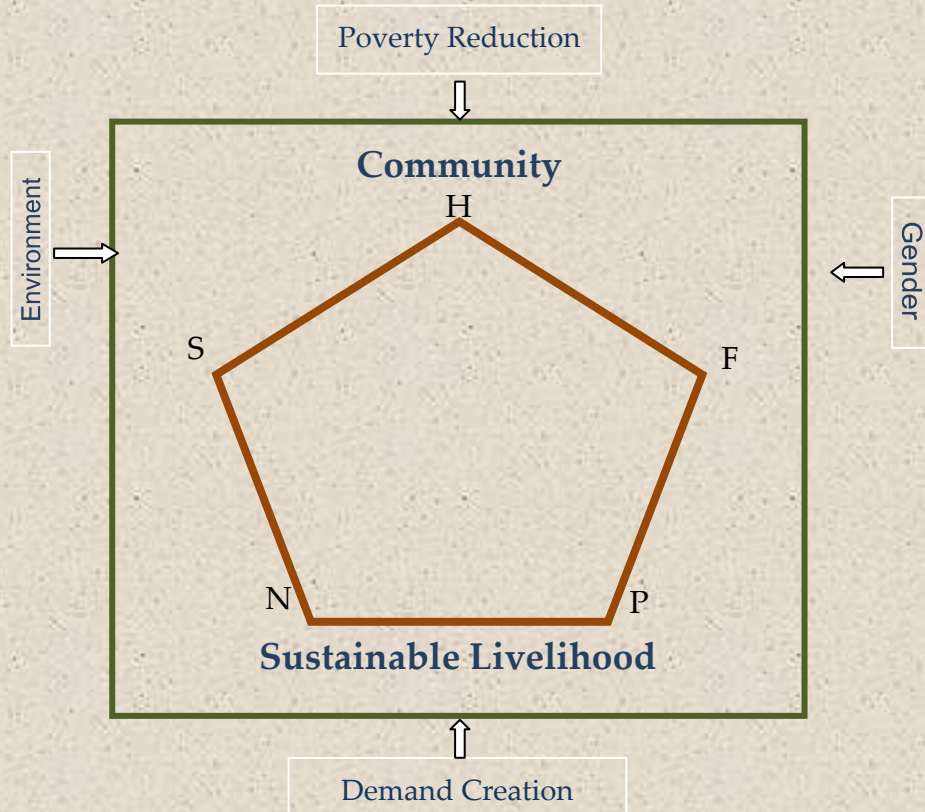
Exports of Minerals

(Tonnes, unless otherwise specified) Rs. millions

Mineral Type	2005	2006	2007	2008
Construction Materials				
Dimension stone	42.43	44.61	69.63	65.38
Other Minerals				
Quartz	472.47	518.74	832.64	862.74
Graphite	276.14	329.63	372.32	405.07
Mica	58.75	91.95	127.99	98.94
Gemstone (carats)	8,004.70	9,853.20	10,444.20	10,066.80

North East Community Development Project (NECCDEP)

Community Development –An integrated Approach



- 1 – H - Human Resource
- 2 – P - Physical Resource
- 3 – F - Financial Resource
- 4 - N - Natural Resource
- 5 - S - Social Resource

**Exist Strategy
for
Sustainability
by
Institution Strengthening**

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