



GUJARAT NRE MINERALS LIMITED

**SUBSIDENCE MANAGEMENT &
MONITORING**

NRE Wongawilli Colliery

LW's 11, 12, 15, 16, 19 & PE1

**Subsidence Management & Monitoring
Program**

November 2008

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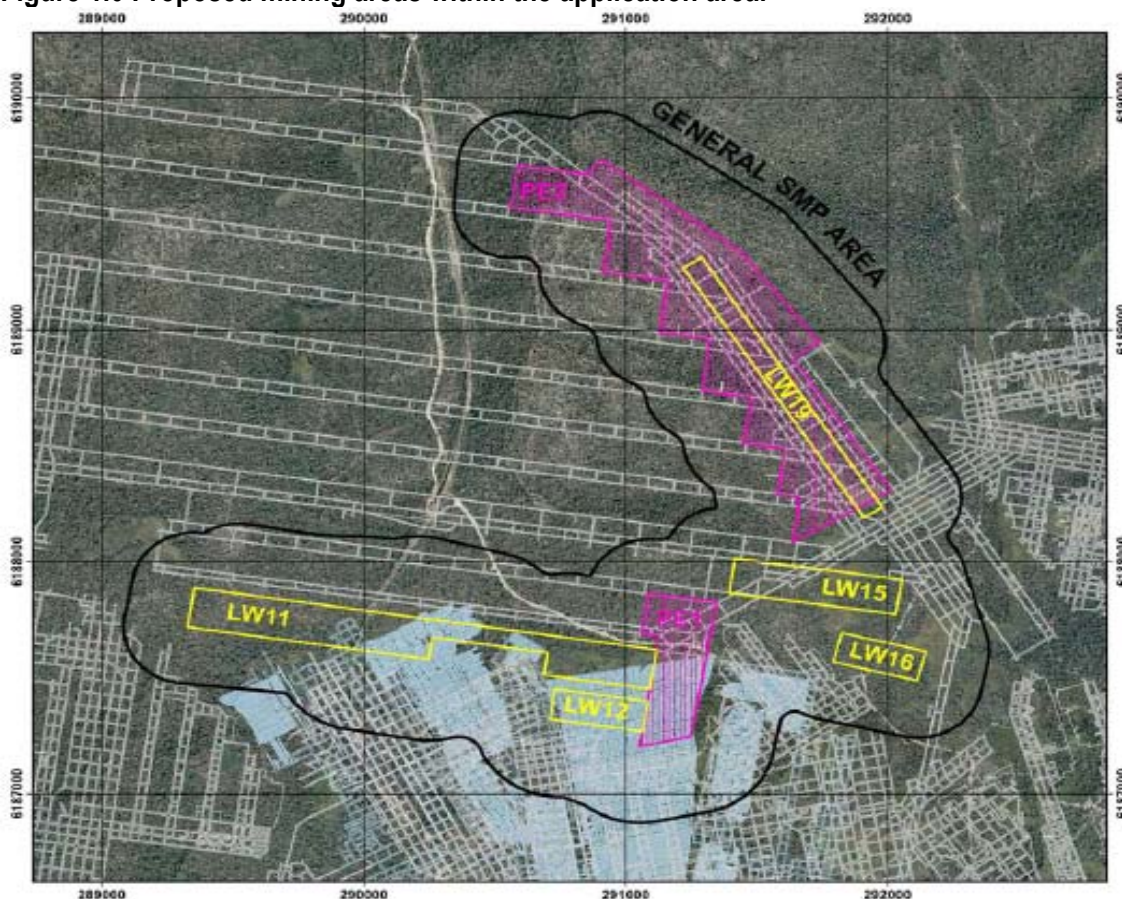
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1. INTRODUCTION

Gujarat NRE Minerals Limited is planning to undertake underground coal mining operations using workings formally utilised by Elouera Mine to extract coal from the Wongawilli Seam using longwall mining and pillar extraction techniques. The proposed mining areas are located adjacent to previous Elouera workings and within the Cordeaux and Avon Catchments of the Sydney Catchment Authority (SCA) Special Areas (**Figure 1.0**).

Figure 1.0 Proposed mining areas within the application area.



Accompanying this Subsidence Management and Monitoring Plan (SMMP) is a Written Report and Subsidence Management Plan (SMP) prepared and submitted pursuant to the Applications Guidelines for Subsidence Management Approvals, 2003. The application area includes Longwalls 11, 12, 15, 16, 19 and Pillar Extraction area 1, which are located adjacent to previously mined areas using longwall techniques. A SMP and EMMP have been submitted for approval following discussions with the Sydney Catchment Authority (SCA).

The application considers:

- the area on the surface enclosed by the 35° angle of draw from the limit of proposed mining, and
- other specific surface and sub-surface features outside this area that may be affected by mining induced ground movements and far field effects.

Natural and man made features and infrastructure have been identified within the vicinity of mining, including natural vegetation and small watercourses, swamps, threatened species, cliffs, steep slopes, rock cuttings, Fire Roads, 4WD tracks and electrical services.

This report outlines the environmental and surface monitoring proposed for the application area.

The monitoring program outlined in this report is designed to:

- provide data which allows validation of mining related impacts and impact predictions, particularly assessing areas of uncertainty;
- identify any unexpected surface movements or impacts due to mining;
- gain knowledge to support future mining, including refinement of impact predictions;

- ensure response management actions and contingencies plans are implemented should trigger levels be reached; and
- allow for advances to the science of impact assessment and monitoring as well as changing technology associated with mining.

2. INFRASTRUCTURE MONITORING

The key items of infrastructure requiring monitoring and management are the *Fire Roads and 4WD tracks* that exist within SCA land and the TransGrid *330 kV transmission line*.

The aim of the monitoring programme is to collect baseline and impact data that adequately addresses requirements of the NRE Wongawilli SMP. The proposed and ongoing monitoring program will specifically:

- monitor surface ground movements at and near the transmission tower;
- undertake regular observational monitoring for impact and serviceability;
- compare actual movements and impacts with predicted movements and impacts;
- satisfy the objectives of the SMP;
- satisfy the objectives of agreed management plans between NRE and relevant stakeholders; and
- meet the expectations of stakeholders, including the community and government.

Ongoing discussions with infrastructure owners are underway and appropriate management and monitoring plans have been developed where determined necessary. Appropriate plans, where required, are being implemented. These plans include trigger points for appropriate actions and remediation works and are detailed below.

Regular meetings will occur between Gujarat NRE and infrastructure owners where necessary.

Owners will be notified of impacts greater than predicted or when trigger levels outlined in agreed management plans are reached. This notification will be immediate if emergency response is required or generally within 24 hrs of identification where a non-emergency response is required.

Reports will be provided comparing predicted and observed movements and impacts as required under the SMP guidelines. Reporting to infrastructure owners will be undertaken on a regular basis.

Table 2.1 – Fire Road and 4WD Track Monitoring and Management

| Management Period | Monitoring Proposed | Trigger | Response |
|---|--|---------------------------------------|---|
| Baseline studies prior to mining | <ul style="list-style-type: none"> • Observation of road condition • Once prior to mining • Reported in SMP Reports | Observation of unsafe road conditions | Report condition to SCA |
| During mining | <ul style="list-style-type: none"> • Observation of road • Fortnightly during extraction • Reported in AEMR | Minor cracking | Notification to SCA within 24 hrs, using photographic record |
| | | Major cracking or traffic impedance | <ul style="list-style-type: none"> *Notification to SCA immediately *Make area safe as soon as practicable *Proposal for rectification within 1 week *Completion of works following approval from SCA *Additional monitoring |
| Post mining | <ul style="list-style-type: none"> • Observation of road • Monthly following mining for 6 months • Reported in AEMR | Minor cracking | As above |
| | | Mitigation works unsuccessful | As above |

Note: Where impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

Table 2.2 – Transmission Line Monitoring and Management (Tower 37-6)

| Management Period | Monitoring Proposed | Trigger | Response |
|---|---|--|-------------------------------|
| Baseline studies prior to mining | <ul style="list-style-type: none"> • Observation of tower condition • Survey measurement for later comparison • Once prior to mining • Reported in SMP Reports | Observation of unsafe tower conditions | Report condition to TransGrid |
| During mining | <ul style="list-style-type: none"> • Observation | Observation of unsafe tower conditions | Report condition to TransGrid |
| Post mining | <ul style="list-style-type: none"> • Observation of tower condition • Survey measurement for later comparison • Once following subsidence • Reported in Survey Reports to DPI and TransGrid | Observation of unsafe tower conditions | Report condition to TransGrid |

Note: Where impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

3. MONITORING OF NATURAL FEATURES

The significant aspects of natural features that require monitoring within the application area include the following:

- Cliffs and Steep Slopes;
- Water;
- Swamps;
- Threatened Species; and
- Aquatic Ecology.

The monitoring of these key items will contribute to baseline assessments and impact monitoring, during mining. In the unlikely event that impacts are observed, the program will support development of any mitigation or rehabilitation plans required.

3.1. CLIFFS AND STEEP SLOPES MONITORING

There are a number of cliff lines and steep slopes identified within the application area. One of the prime objectives of this plan is to prevent injuries as a result of cliff instability that may be induced by mining related impacts. Regular monitoring of ground movement and rock face stability in potentially unstable areas, as well as implementing appropriate controls where necessary, will achieve this. It is expected that with the restricted access to SCA areas already enforced, the probability of people being in the vicinity of any rock fall is reduced. Given the low levels of use of the area and the rugged terrain, it is considered that there is a very low level of risk from rock falls.

Results obtained from monitoring associated with this plan will be used to determine ongoing monitoring requirements, appropriate controls and responses relating to potential surface instability associated with coal extraction within the application area. This will contribute to an improved understanding of the effects of mining on steep slopes and cliffs, and assist the management of the area to minimise risk to members of the public, SCA and monitoring personnel.

Table 3.1 outlines the nature and frequency of monitoring and the actions proposed to manage impacts on cliff formations.

Table 3.1 – Cliff and Steep Slopes Monitoring & Management

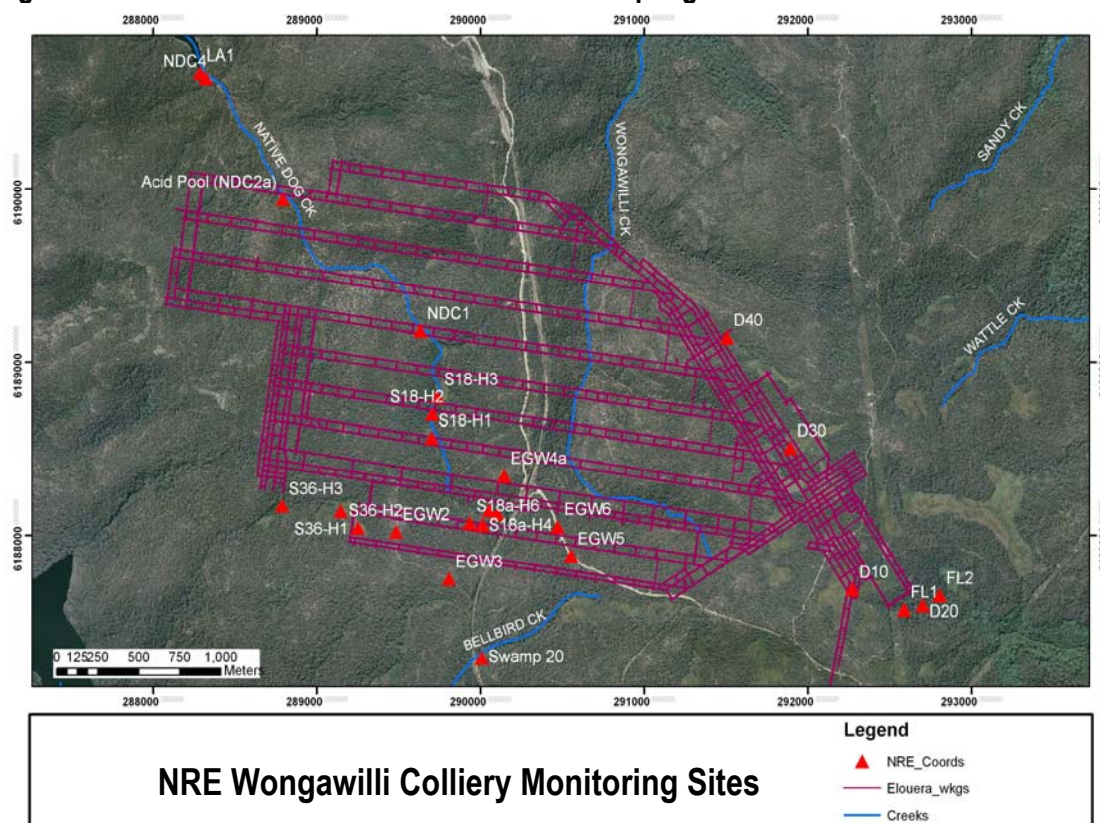
| Management Period | Monitoring Proposed | Trigger | Response |
|----------------------------------|---|--|--|
| Baseline studies prior to mining | <ul style="list-style-type: none"> • Observation of cliff and steep slope condition • Once prior to mining • Reported in SMP Reports | Observation of unstable conditions | Take into account impact assessment and SMP |
| During mining | <ul style="list-style-type: none"> • Observation of cliffs and steep slopes • Monthly during extraction • Reported in AEMR | Observation of unstable conditions | Notification to SCA within 24 hrs, using photographic record |
| | | Major cliff collapse or steep slope movement | <ul style="list-style-type: none"> *Notification to SCA immediately *Make area safe immediately *Proposal for rectification within 1 week *Completion of works following approval from SCA *Additional monitoring |
| Post mining | <ul style="list-style-type: none"> • Observation of cliffs and steep slopes • Monthly following mining for 6 months • Reported in AEMR | As above | As above |
| | | Mitigation works unsuccessful | As above |

If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

3.2. WATER MONITORING

The application area is located within a water catchment area that includes a number of creeks that flow through the area, these include Native Dog Creek, Bellbird Creek, Flying Fox Creek #1, parts of Wongawilli Creek and its tributaries as shown in **Figure 3.2**. As it is indicated in the NRE written report, these water courses are ephemeral and as such are natural depressions running into creeks and swamps within and surrounding the application area. These drainage lines are often called ‘feeder creeks’. They range in size from 0.5 to 1m in width with a depth no greater than 0.5m. The beds of the drainage lines are considered to consist of alluvial material with scattered rocky outcrops.

Figure 3.2 Surface features and Environmental sampling locations.



Water quality and flow are measured on a weekly basis in Wongawilli Creek and at longer periods of time for other water courses. It is understood from previous water quality monitoring that trends are strongly influenced by rainfall events and evidence of localised mining influence has been identified.

The water monitoring program proposed for the application area is provided in **Table 3.2**. Fortnightly monitoring of surface waters upstream and downstream of the application areas is proposed, involving flow, field water quality parameters and an extensive physio/chemical laboratory suite. Water quality parameters to be monitored have been determined to reflect adequately any mining related impacts to these areas and are attached as **Appendix 1**.

Table 3.2 – Water Quality and Flow Monitoring Program

| Monitoring Activity | Description | Frequency | Reporting |
|---|--|-------------|--|
| ► <i>Baseline Monitoring</i> – 6 months prior to and following the completion, of mining | | | |
| Detailed laboratory Analysis | Water sampling locations: • D 10 • D 20 • D 30 • D 40 | • 2 Monthly | *In annual reporting and as required for technical assessment *Files kept for data collection |
| Water flow | Water sampling locations: • D 10 • D 20 • D 30 • D 40 | • Monthly | |
| Field water quality parameters | Laboratory analysis at water sampling locations: • D 10 • D 20 • D 30 • D 40 | • Monthly | |
| Water levels in pools | Survey against reference points: • D 10 • D 20 • D 30 • D 40 | • Monthly | |
| ► <i>Mining Impact Monitoring</i> – 1 month prior to and following the completion, of mining | | | |
| Detailed laboratory Analysis | Water sampling locations: • D 10 • D 20 • D 30 • D 40 | • 2 Monthly | *In annual reporting and as required for technical assessment *Files kept for data collection *Any significant changes in monitored aspects will be reported to SCA within 24 hrs of identification and mitigation measures to be proposed within 1 month. |
| Water flow | Water sampling locations: • D 10 • D 20 • D 30 • D 40 | • Weekly | |
| Field water quality parameters | Laboratory analysis at water sampling locations: • D 10 • D 20 • D 30 • D 40 | • Weekly | |
| Water levels in pools | Survey against reference points: • D 10 • D 20 • D 30 • D 40 | • Monthly | |

If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.
NRE Wongawilli Environmental Subsidence Monitoring & Management Program

It is proposed to monitor surface water flows and quality upstream of the impact area in suitable standing water within those related swamp/s as required and in the water course which flows from the swamp/s downstream of the mining influence.

3.3. MONITORING OF SWAMPS AND DRAINAGE LINES

The application area consists of five (5) longwall mining blocks and one (1) pillar extraction block, that are located in an area supporting surface features such as ephemeral drainage depressions and swamps. Generally, these swamps are associated with the headwaters of a number of creeks within the application area.

Shallow aquifers have been identified associated with drainage lines and upland swamps in the area. Monitoring of groundwater is being conducted in upland swamps and associated drainage lines in the area shown in **Figure 3.2**. Surface monitoring of the drainage lines and swamps is outlined in **Table 3.3**.

The swamp monitoring is a detailed program that has been undertaken in a large number of swamps in the area in association with previous SMP applications, since winter 2003. Swamp monitoring and Riparian zones monitoring for flora and fauna is expected to include vegetation transects, vegetation quadrats, amphibians and invertebrates. Further and continued monitoring of these features will be implemented and discussed within the appropriate annual reports.

Table 3.3 – Drainage Lines & Swamps Monitoring Program

| Management Period | Monitoring Proposed | Trigger | Response |
|--|--|--|--|
| Baseline studies prior to mining | <ul style="list-style-type: none"> • Observation of swamp and drainage depressions including presence/absence of water • subsidence fracturing • changes in flora/fauna • Twice per year | Observation of fracturing or water loss | <ul style="list-style-type: none"> *Report to SCA *Additional studies as required |
| During mining (likely to be a small No. of observations) | <ul style="list-style-type: none"> • Observation of swamp and drainage depressions including presence/absence of water • subsidence fracturing • changes in flora/fauna • Twice per year | *Minor cracking | <ul style="list-style-type: none"> *Report to SCA *Additional studies as required *Photographic record |
| | | <ul style="list-style-type: none"> *Major cracking *Water loss *Flora/Fauna changes *Increased erosion | <ul style="list-style-type: none"> *Notification to SCA immediately *Proposal for rectification within one month *Completion of works following approval from SCA *Additional monitoring |
| Post mining | <ul style="list-style-type: none"> • Observation of swamp and drainage depressions including presence/absence of water • subsidence fracturing • changes in flora/fauna • Twice per year | *Minor cracking | As above |
| | | *Mitigation works unsuccessful | As above |

If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

3.4. AQUATIC ECOLOGY MONITORING

Monitoring of freshwater aquatic habitats and biota is undertaken within the general area of mining extraction. There is no substantial aquatic habitat in the vicinity of Longwall and Pillar Extraction mining areas that can be monitored on a meaningful basis. Observational monitoring of the area will include assessments of impacts to aquatic biota and habitat. This will be undertaken in accordance with the extensive water quality monitoring program.

3.5. MONITORING OF TERRESTRIAL FLORA AND FAUNA

Terrestrial flora and fauna assessments for the application area are largely habitat based assessments and follow the outline below:

- undertake threatened species database searches for a 10km radius of the study area;
- apply subsidence predictions to the study area noting sites or locations that may exhibit greater surface impacts;
- undertake a habitat level assessment and survey of the study area including detailed assessment of any area of habitat features that may exhibit surface impacts due to subsidence; and
- report conclusions of the study area and impact assessment.

Monitoring of terrestrial habitats and biota will be undertaken in the general area of mining extraction where required. Observational assessment of the threatened species will specifically include, Little Johns Tree Frog, the Red-crowned Toadlet and the Giant Burrowing Frog. It is also expected that ridge tops monitoring will include vegetation quadrat surveys and invertebrates observations.

The monitoring of terrestrial flora and fauna is outlined in **Table 3.5.** and discussions will be included in annual reports.

Table 3.5 – Terrestrial Flora & Fauna Monitoring Program

| Management Period | Monitoring Proposed | Trigger | Response |
|---|---|--|---|
| Baseline studies prior to mining | <ul style="list-style-type: none"> • Observation of identified threatened species • Amphibian monitoring • Swamp and riparian vegetation monitoring • Ridge tops • Once prior to mining ▽ • Reported in SMP Reports | Observation of surface mining related impacts | Take into account impact assessment and SMP |
| During mining | <ul style="list-style-type: none"> • Observation of identified threatened species • Amphibian monitoring • Swamp and riparian vegetation monitoring • Ridge tops • Bi-Annually during entire extraction period • Reported in AEMR | Observation of mining related impacts to surface | Notification to SCA/NPWS within 24 hrs, using photographic record |
| | | Major impacts to threatened species habitat | <ul style="list-style-type: none"> *Notification to SCA/NPWS immediately *Proposal for threatened species management within 1 week *Completion of management task following approval from SCA/NPWS *Additional monitoring |
| Post mining | <ul style="list-style-type: none"> • Observation of identified threatened species • Amphibian monitoring • Swamp and riparian vegetation monitoring • Ridge tops • Annually for 1 year post extraction period • Reported in AEMR | As above | As above |
| | | Management task unsuccessful | As above |

▽ The southern coal field enquiry recommends that two years of baseline data be acquired, however, this is not available.

If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA/NPWS.

3.6. EUROPEAN AND INDIGENOUS ARCHAEOLOGY MONITORING

Assessment

European and Indigenous monitoring follows the outline below:

- undertake updated database searches for European and Indigenous Heritage;
- assess previous work for adequacy of coverage and after considering the subsidence predictions, define a survey area to adequately survey the study area;
- re-survey sites previously identified and any new sites to determine site significance;
- prepare a report detailing the sites of archaeological significance and apply the subsidence predictions to determine the potential impacts;
- undertake geotechnical assessments of sites that may be subject to mining related impacts to determine the likelihood of such features being impacted; and
- determine a management and monitoring program based on the impact assessment.

Note: It has been determined through assessment that the indigenous archaeological sites identified within the application area, possess no historical or heritage significance.

Monitoring

The predicted strains associated with mining related impacts on the identified archaeological sites are expected to be of low significance, as they are predominantly small in size compared to the application area. However, these sites will be monitored for potential impacts by undertaking the following:

- accurate base line recording of the heritage feature;
- monitor the site/s for impacts as required after mining; and
- document and report the monitoring program.

4. CONSULTATION

Planning for the extraction of Longwall's 11, 12, 15, 16, 19 and Pillar extraction area 1 has been conducted in consultation with key stakeholders such as SCA, DPI, DECC and WCC. NRE Wongawilli will endeavour to maintain regular communicative channels with relevant stakeholders and owners of infrastructure. Other agencies will be consulted as required. The occurrence of any impacts greater than predicted will be communicated to appropriate stakeholders within 24 hours of detection. Existing community consultation developed by NRE Wongawilli Colliery will continue. Notifications of approvals are sent to relevant stakeholders.

Appendix 1: Water quality parameters monitored

| GEOCHEMICAL ANALYSIS | FIELD ANALYSIS | UNITS | METHOD |
|---------------------------------|-------------------------------|--------------|--------|
| pH | pH | | EA005 |
| Conductivity @ 25°C | Specific conductivity | µS/cm | EA010 |
| Temperature | Temperature | Deg C. | |
| | Dissolved oxygen | % Saturation | |
| | Turbidity | NTU | |
| | Oxidation Reduction potential | mV | |
| Total Dissolved Solids (TDS) | | mg/L | |
| Suspended Solids (SS) | | mg/L | |
| Calcium | | mg/L | ED005 |
| Magnesium | | mg/L | ED010 |
| Sodium | | mg/L | ED015 |
| Potassium | | mg/L | ED020 |
| Alkalinity as CaCO ₃ | | mg/L | ED037 |
| Sulphate | | mg/L | ED040 |
| Chloride | | mg/L | ED045 |
| Iron | | mg/L | EG005 |
| Aluminium | | mg/L | EG020 |
| Arsenic | | mg/L | EG020 |
| Copper | | mg/L | EG020 |
| Manganese | | mg/L | EG020 |
| Nickel | | mg/L | EG020 |
| Lead | | mg/L | EG020 |
| Selenium | | mg/L | EG020 |
| Zinc | | mg/L | EG020 |
| Ammonia as N | | mg/L | EK055 |
| Nitrite and Nitrate as N | | mg/L | EK059 |
| Total Kjeldahl Nitrogen as N | | mg/L | EK061 |
| Phosphorus as P -Total | | mg/L | |
| Dissolved Organic Carbon | | mg/L | |
| Chemical Oxygen Demand | | mg/L | |