Assessment Guide
Primary Agriculture

Manage water Quality parameters

Assessor: ............................................................
Workplace / Company: ........................................
Commodity: .............................. Date: ....................

The availability of this product is due to the financial support of the National Department of Agriculture and the AgriSETA.
Before we start...

This assessment guide contains all necessary activities and instructions that will enable the assessor and learner to gather evidence of the learner’s competence as required by the unit standard. This guide was designed to be used by a trained and accredited assessor whom is registered to assess this specific unit standard as per the requirements of the AgriSETA ETQA.

Prior to the delivery of the program the facilitator and assessor must familiarise themselves with content of this guide, as well as the content of the relevant Learner Workbook.

The assessor, facilitator and learner must plan the assessment process together, in order to offer the learner the maximum support, and the opportunity to reflect competence.

The policies and procedures that are required during the application of this assessment are available on the website of the AgriSETA and should be strictly adhered to. The assessor must familiarise him/herself with this document before proceeding.

This guide provides step-by-step instructions for the assessment process of:

<table>
<thead>
<tr>
<th>Title</th>
<th>ID Number</th>
<th>NQF Level</th>
<th>Credits</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Certificate in Animal Production</td>
<td>48979</td>
<td>4</td>
<td>120</td>
<td>☐</td>
</tr>
<tr>
<td>National Certificate in Plant Production</td>
<td>49009</td>
<td>4</td>
<td>120</td>
<td>☐</td>
</tr>
</tbody>
</table>

This unit standard is one of the building blocks in the qualification listed below. Please mark the qualification you are currently assessing, because that will be determined by the context of application:

Please mark the learning program you are enrolled in:

<table>
<thead>
<tr>
<th>Are you enrolled in a:</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learnership?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Skills Program?</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Short Course?</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Note to Assessor:
If you are assessing this module as part of a full qualification or learnership, please ensure that you have familiarized yourself with the content of the qualification.
1. What is the main effect of the PWQF?
2. Why is a clogged emitter detrimental to production?
3. Which factors will stimulate the growth of microbes in the irrigation system?
4. The pH of the water is 7.85. List your assessments and actions to be taken to optimise this chemical water quality factor?
5. Why is an EC of more than 150mSm\(^{-1}\) an important parameter in production?
6. Why is an SAR value of >1 is a negative factor in production?
7. What is the effect of a high concentration of magnesium on the potassium status of trees?
8. Dosing apparatus used to apply acids and disinfectants are grouped into which two groups?
9. Name three types of filters used to remove PWQF from irrigation water?

**Model Answer(s):**

1. The main effect of the physical water quality factors (PWQF) is blocking or clogging of the emitters.
2. The effects of clogged emitters are so devastating on production that water classified as having a Low Clogging Hazard still needs treatment, because some of these factors have a cumulative effect on the irrigation system. Therefore, apart from the initial analysis of the water, the continuous monitoring of these factors in the piping and emitters is essential.
3. The growth is aggravated by addition of nitrogen, phosphorus and organic carbon (molasses, organic acids or buffers). Applying nutrient solutions through the irrigation system will stimulate the growth of the microbes.
4. The pH of the water is 7, 85: List your assessments and actions to be taken to optimise the chemical water quality factors.

<table>
<thead>
<tr>
<th>Solutions of most pesticides and nutrient sprays need to be acidified.</th>
<th>Select the most suitable acid or buffer solution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In combination with high Ca levels, scale forming and clogging are possible.</td>
<td>Acidify continuously for drippers and ad hoc for micro-jets</td>
</tr>
<tr>
<td>Acidification of water used in micro-jet systems can possibly be justified during July to November</td>
<td></td>
</tr>
</tbody>
</table>
5. When the EC of the water is greater than 150mSm⁻¹ plants need energy to utilise the water and production will suffer.

6. Crusting will slow down the infiltration rate and free water will accumulate on the surface. This is the first sign of the detrimental effect of too high sodium content.

7. Magnesium and potassium act mutually antagonistic, i.e. they oppose each other’s uptake and functioning.

8. Active Dosing Apparatus.
    Passive Dosing Apparatus

9. Mesh or screen filters.
    Ring or disc filters.
    Sand filters.

Acidification of irrigation water used in drip systems is a must to reduce pH, add nutrients and utilise the nutrients already in the water.
1. What are the reasons for treating irrigation water?
2. Are all pesticides more efficient at a pH less than 6.00?
3. Lists four types of precipitates that can accumulate in emitters and irrigation pipes.

**Model Answer(s):**

1. Improve the quality, 
   Minimise the negative effect of the water quality factor on the soil, tree, and environment; and/or 
   Improve economic returns.
2. No
1. According to the standard set by Leading drip irrigation supplier, the concentration of 60% nitric acid in the system should be 0.6%. Calculate the concentration if the acid available has a concentration of 50%.

2. Why is nitric acid the preferred acid in lowering the pH of irrigation water?

3. What is the meaning of a maintenance and corrective treatment?

4. Describe the terms chlorine and chloride.

5. Name the three common water quality treatment processes.

6. Can all the CWQF be improved? Motivate your answer.

7. What is the best method to determine the volume acid required to acidify the water to a certain pH?

8. Name the best method to evaluate the chlorination process.


10. What CWQF can accurately be measured on the farm or in the orchard?

**Model Answer(s):**

1. \[0.6 \times \frac{60}{50} = 0.72\%\]

2. Nitric acid is the preferred chemical for this purpose, because all nitrates are soluble in water and nitrate is also an essential nutrient.

3. Maintenance Application
   In the maintenance program, these chemicals are applied at frequencies determined by historical data and current assessments and/or analyses. The microbial counts in the irrigation water initiate the inclusion in the maintenance program. Data on clogged drippers or micro-jets and analyses of the deposits in the pipes determine the frequency.

4. Corrective Application
   Corrective or shock treatments are done to bring the microbial population down to acceptable levels in short period. This is done by applying the chemical at a high concentration at the end of the irrigation cycle.

5. Chloride is formed when chlorine has oxidised organic material or manganese.
   In the process the chlorine atom is reduced to the inactive chloride form. Chloride will not oxidise organic material and at a moderate concentration kill microbes.

6. filtration, acidification and disinfection

7. No, it is often not cost effective to remove certain chemicals out of the available water supply.

8. Managing the pH of the irrigation water can be done manually or continuously aided by a pH-sensor and a computer. The acidification process of irrigation...
water can also be managed by recording the volume of water treated and the volume of acid used in the process. These volumes should add up to the estimated acid usage. The volume of acid is best be determined by a chemical titration. Otherwise the volume can be calculated based on the concentration of carbonates and bicarbonates.

8. By measuring the concentration of the free chlorine at the most distant emitter
   The quality of any management system depends on the:
   Relevance of the measurements taken
   Accuracy of measurements
   Frequency of testing
   Frequency of data assessment
   Frequency of reporting

9. A management system can be killed by too much meaningless data. Too many measurements require time and effort and are the first thing to be neglected when time is limited. A few measurements that can be done quickly and accurately, and that have a meaningful input on the decision making process, should be selected.

10. pH and EC
1. Two water sources are available for irrigation. Source A is of good quality with an EC of 30 mSm⁻¹ and source B has an EC of 130 mSm⁻¹. How can the volume of irrigation water with an acceptable quality be increased?

2. Estimate the EC of the mix when two waters with an EC of 100 and 50 mSm⁻¹ are mixed in a ratio of 1 to 2.

**Model Answer(s):**

1. The simplest method is to mix waters of a low and high salt content in order to get water with a medium, but acceptable, salt content.

2. \[ \frac{1 \times 100 + 2 \times 50}{2} = 100 \text{ mSm}^{-1} \]
Before the knowledge test is undertaken, the learner must be reminded of what is expected from him / her in terms of summative and reflexive competence. Read and explain to the learner, the **Preparation for Your Final Assessment** section in the learner workbook. Learners and assessor should sign off this section to acknowledge that this step was completed.

Please set up a knowledge test from the questions given as a guideline to learners and supply each learner with a test sheet.

Supply each report with the following heading:

<table>
<thead>
<tr>
<th>Questions</th>
<th>Model Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify the water source on the farm where you are performing your practical work</td>
<td>No specific model answer due to different circumstances</td>
</tr>
<tr>
<td>2. List all the water quality factors that might affect this water source and categorise the risks according to chemical, physical or microbiological factors.</td>
<td>No specific model answer due to different circumstances</td>
</tr>
<tr>
<td>3. Obtain values for the following regarding the water that you are investigating:</td>
<td>No specific model answer due to different circumstances</td>
</tr>
<tr>
<td>pH EC SAR Ca Mg Cl B N Total suspended solids Dissolved Oxygen</td>
<td></td>
</tr>
<tr>
<td>4. Now assess the water and decide on required actions</td>
<td>No specific model answer due to different circumstances</td>
</tr>
<tr>
<td></td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>What type of filtration system will have to be installed if this water is to be used for irrigation purposes? Be very specific regarding type of filter and pore sizes.</td>
</tr>
<tr>
<td>6</td>
<td>What will be the result and advantages of your actions on the water</td>
</tr>
<tr>
<td>7</td>
<td>What is the clogging hazard of the water and what can you do about it</td>
</tr>
<tr>
<td>8</td>
<td>Would you aerate the water? If yes, how and why?</td>
</tr>
<tr>
<td>9</td>
<td>Would you consider acidification of the water? If yes, how and why?</td>
</tr>
<tr>
<td>10</td>
<td>Would you disinfect the water? If yes, how and why?</td>
</tr>
<tr>
<td>11</td>
<td>Would you chlorinate the water? If yes, how and why?</td>
</tr>
<tr>
<td>12</td>
<td>How often will you perform these tests on the water in future?</td>
</tr>
<tr>
<td>13</td>
<td>What will you test routinely on the water in future?</td>
</tr>
<tr>
<td>14</td>
<td>What will you do with the data that you obtain from each of these water tests?</td>
</tr>
<tr>
<td>15</td>
<td>If you were in charge of water quality management, what would you report and to whom would you report it?</td>
</tr>
</tbody>
</table>
## Assessment Feedback Form

### Comments / Remarks
Feedback to learner on assessment and / or overall recommendations and action plan for competence:

### Feedback from learner to assessor:

### Assessment Judgement
You have been found:

- [ ] Competent
- [ ] Not yet competent in this unit standard

### Actions to follow:

- [ ] Assessor report to ETQA
- [ ] Learner results and attendance certification issued

### Learner’s Signature:
Date:

### Assessor’s Signature:
Date:

### Moderator’s Signature:
Date: