This edition – October 2015

Section D - Lesson Plans

- Geography
- Grade 10 FET

Rivers & their catchments: Examples of fieldwork lesson plans for Grade 10 FET

This is a product of The Water Research Commission: Project No. K5/2350

WRC: Project No. K5/2350

This edition – October 2015

SECTION D

RIVERS & THEIR CATCHMENTS

Some examples of Fieldwork Lesson Plans

For the CAPS

GEOGRAPHY: GRADE 10 FET

CONTENTS

Dear Educator: The model Fieldwork Lesson Plans in this section have been developed in compliance with the CAPS curriculum documents. They are simply examples of what is possible. Why not work with a colleague to see how they suit your local situation and make any changes that might be necessary?

WRC: Project No. K5/2350

Geography: CAPS Further Education & Training Phase
Model Fieldwork Lesson Plan for Grade 10 Fieldwork
Scoping the wetland environment

Grade 10: Geographical fieldwork – Wetlands and Water Security

Term 4 Topic: Water Resources: Water management in South Africa
Lesson focus: Scoping the wetland environment (Personal experiences of the wetland ecosystem)
Duration: 1 hour of fieldwork

THE FET GEOGRAPHY CURRICULUM

Section 2.2 of the CAPS FET Geography curriculum (*Geography Aims*) states that:
"*During Grades 10, 11 and 12 learners are guided towards developing the following knowledge, skills and attitudes."*

These include:
1. Describing and explaining the dynamic interrelationship between the physical and human worlds
2. Developing a commitment towards sustainable development
3. Making and justifying informed decisions and judgments about social and environmental issues

Section 4.3.2 of the Curriculum lists the formal assessment requirements for FET Geography.
The assessment tasks include the ability of learners to:
1. Identify and solve problems and make decisions using critical and creative thinking
2. Work effectively with others as members of a team, group, organisation and community
3. Organise and manage themselves and their activities responsibly and effectively
4. Collect, analyse, organise and critically evaluate information
5. Communicate effectively using visual, symbolic and/or language skills in various modes
6. Use science and technology effectively and critically show responsibility towards the environment and the health of others
7. Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

Fieldwork: The Curriculum stipulates 4 hours of fieldwork during the first term. Why not use part of this allocation to encourage environmental learning for the year ahead amongst the learners?

Why not discuss with a colleague your understandings of the directives contained in the Curriculum as they apply to fieldwork in Geography?

SCOPING - AN IMPORTANT RESEARCH TOOL FOR GEOGRAPHY

Before starting a major programme of fieldwork, geographers may go into the field to see what has to be done. This is known as SCOPING (looking "widely"). This fieldwork is all about scoping the wetland environment with a view to planning a more in-depth study.

As in the fieldwork to follow: *What makes a wetland a wetland? Why are wetlands strategically important resources?*

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A NOTE ON ECOLOGICAL NICHES

An **ecological niche** is the role and position a species has in its environment, how it meets its needs for food and shelter, how it survives, and how it reproduces.

The wetland environment has a number of different ecological niches. Be on the look-out for them during this discussion of wetland fieldwork.

THE AIM OF THIS FIELDWORK STUDY

- The aim of this fieldwork study is to develop ecological concepts relating to a wetland
- The prime objective of the study is to give practice to learners in the use of scoping techniques for environmental research
- Other objectives relate to curriculum details such as the importance of wetlands for controlling the effects of floods and the slow release of ground-water to the basin below

INTEGRATION WITH OTHER CURRICULA

Extracts from the curricula of other FET learning areas that provide links with Geography:
In preparing fieldwork at a local level, it might be helpful to consider how the work of other Grade 10 curricula relates to your fieldwork.

Languages (A selection of aims of particular reference to Geography fieldwork)
Learning a language should enable learners to:

- Use language appropriately, taking into account audience, purpose and context
- Use language and their imagination to find out more about themselves and the world around them. This will enable them to express their experiences and findings about the world orally and in writing
- Use language to access and manage information for learning across the curriculum and in a wide range of other contexts
- Use language as a means for critical and creative thinking, for expressing their opinions on ethical issues and values and for interacting critically with a wide range of texts

Life Sciences (A selection of aims of particular reference to Geography fieldwork)
By studying and learning about Life Sciences, learners will develop:

- Knowledge of key biological concepts, processes, systems and theories
- An understanding of the ways in which humans have impacted negatively on the environment and the organisms living in it
- Deep appreciation of the unique diversity of past and present biomes in Southern Africa and the importance of conservation
- An awareness of what it means to be a responsible citizen in terms of the environment and life-style choices that they make
- A level of academic and scientific literacy that enables them to read, talk about, write and think about biological processes, concepts and investigations.

Life Orientation (Two aims of particular reference to Geography fieldwork)
Life Orientation aims to:

- Guide and prepare learners to respond appropriately to life's responsibilities and opportunities
- Guide learners to make informed and responsible decisions about their own health and well-being and the health and well-being of others;

Tourism (Two aims of Tourism that link with wetland fieldwork.)

- Mapwork
- Sustainable and responsible tourism: This relates in particular to the place of conservation with regard to eco-tourism. Wetland habitats as conserved areas are also areas of interest and importance to bird-watchers, botanists and others.

PREPARING FOR THE FIELDWORK: PLANNING AND RESOURCES

Success depends upon previous preparation, and without such preparation there is sure to be failure.

PLANNING

Using a chalk-board summary you should first explain how the fieldwork will be undertaken. Using your own words and providing locally known examples, take time to revise or explain to the learners important concepts of ecosystems and habitats.

Ecosystem: A biological community of interacting organisms and their physical environment.

Habitat: The natural home or environment of an animal, plant, or other organism.

Then help the learners organise themselves into small groups (e.g. 4 – 6). Ask them to give their groups names that are appropriate to the research (e.g. Water Wonders, The Otters; The Weavers). In the home language of the learners if preferred.

FIELDWORK RESOURCES

The resources listed below are the minimum suggested for the fieldwork. If your school can access these they would add value to the fieldwork. For well-resourced schools, educators can also use a Google Earth image of the wetland together with the 1:50 000 topographic map.

FOR EACH GROUP:

- A 1:50 000 topographic map on which the wetland appears -One map for every 4-6 learners. Maps are easily available from: The Chief Directorate Surveys and Mapping, Van Der Sterr Bldg, Rhodes Ave, 7700, Mowbray, Cape Town, Western Cape, South Africa.
  Phone Number: 021 6584300. In July 2015 these maps were priced at R13.50 each.
  NB: If your department has the resources each map can be supplied laminated at an additional cost of R27 per map.

FOR EACH LEARNER:

- RECORD KEEPING: MY WETLAND FIELDWORK RECORDS -Scoping the wetland ecosystem. The record sheets will be taken in by you to assess the work of each learner.

FIELD EQUIPMENT (To be taken to the field by the teacher):

- A thermometer to sample the air temperature at the time of the field-work
- If available - a wet and dry bulb thermometer (hygrometer). To measure the humidity of the air.
- Sets of Water Clarity Disks - 1 per group
- A bucket for water - Rinsing of hands after the soil puddling tests
- Pictures of birds

CLASSROOM PREPARATION

Mapwork orientation

To orientate the learners with regard to the fieldwork site (remember that Geography is all about place) use the topographic map in which the field- study area in the wetland is mapped.

Working in their groups the learners should complete the worksheet in the Mapwork (MY WETLAND FIELDWORK RECORDS: Scoping the wetland ecosystem).

THE FIELDWORK

Scoping the wetland environment will be undertaken in 7 stages. At each stage the learners will enter their observations in the Records table.

1. FIELD-SKETCHING (See example in the recording sheet at the end of these notes: *My Wetland Fieldwork Records: Scoping the wetland ecosystem)*

The learners should stand at a vantage point from where they can see the whole wetland study area. The field-sketch is intended to engage each learner with the environment of the fieldwork. By making a simple field-sketch the learner is starting to observe the environment of the study area.

Hint: The teacher should encourage the learners by referring them to the example in the Records table. Every learner should try to complete the sketch. Some will be better than others.

2. NOTES ON THE WEATHER

For details of the expected weather on any one day go to the website of the SA Weather Service: http://www.weathersa.co.za/city-pages/
For climate data for your nearest large town go to https://en.wikipedia.org/wiki/Climate_of_South_Africa (Temperatures) and Rainfall for any location in South Africa go to: www.samsamwater.com/climate

THE FIELDWORK

At the time of the fieldwork the learners will measure:

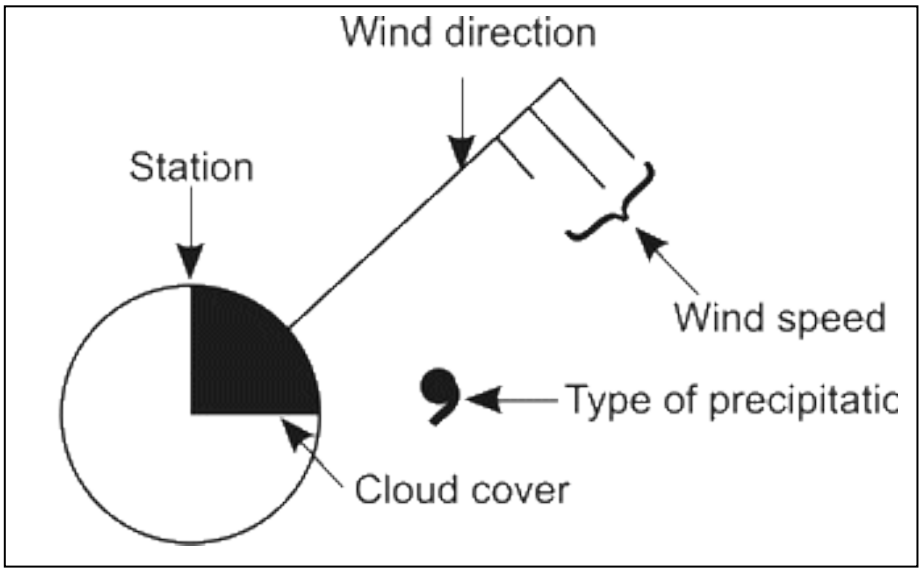
1. The air temperature
2. The humidity of the air (if possible)
3. Cloud cover
4. Wind (Direction and Speed)

1. The air temperature: Measured by the teacher at a height of about 1 metre off the ground (to avoid any radiated heat off the group).

2. Humidity: Measurement demonstrated by the teachers with use of a hygrometer and tables accessed off the internet (Example: *http://www.fpl.fs.fed.us/documnts/fpltn/fpltn-156.pdf)* Why not print a copy for your records?

3. Cloud cover: The learners assess the amount of cloud cover in the sky and record it in the circle.

4. The wind: Wind is measured in terms of both its direction and its speed. Wind speed is assessed in the field by observing the effects that it is having on the environment – as shown in the table below. His known as the Beaufort scale.



This weather station diagram is recording information for one particular place (The exact place where the measurements are being taken).

Print a table for each group of learners.

The Beaufort scale			
Beaufort Number	**Description**	**Km/h**	**Visual**
0	calm	0 - 2	smoke rises vertically
1	light air	2 - 5	smoke drifts slowly
2	slight breeze	6 - 12	leaves rustle
3	gentle breeze	13 - 20	leaves and twigs in motion
4	moderate breeze	21 - 29	small branches move
5	fresh breeze	30 - 39	small trees sway
6	strong breeze	40 - 50	large branches sway
7	moderate gale	51 - 61	whole trees in motion
8	fresh gale	62 - 74	twigs break off trees
9	strong gale	75 - 87	branches break
10	whole gale	88 - 101	trees snap and are blown down
11	storm	102 - 115	widespread damage
12	hurricane	116 - 130	extreme damage

NB: Wind direction is recorded by the direction it is blowing FROM. Look at the weather station diagram on the previous page. Can you see that the wind is coming from the north-east with a speed of 25 kph? (2½ 'feathers' on the arrow).

3. NOTES OF THE LOCAL GEOLOGY

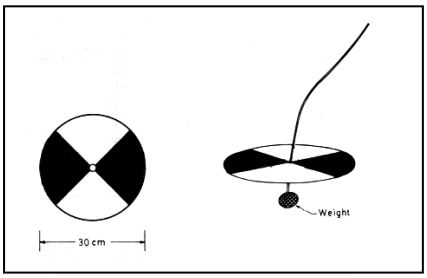
The learners should pick up and examine rocks in the study area. To distinguish between Igneous rocks, which have a have a crystalline structure without layers and sedimentary rocks which show layers.

4. NOTES ON THE STREAM-BED AND WATER IN THE STREAM

- The stream bed: Is the stream bed sandy with few rocks or rocky with many rocks? Which of the two will provide more /better habitats for river species?

- Are there any logs or other objects that might provide habitats for water animals?

- Water clarity: To check if the stream water has any suspended solids in it (e.g. pollution) use a home-made water Clarity Disk. - One for each group of learners.



The disk is a circle cut out of thick cardboard and coloured as shown. Push a length of string through the centre of the disk and tie a weight (e.g. a washer or nut) below it. Place another weight above the disk so that it will sink.
Lower the Disk into the water and check the depth to which you can still see the patterns clearly - If you can still see the pattern clearly to a depth of 30 cm (the length of a ruler) this will show that the water is not polluted with solids.

Using your Water Clarity Disk to measure its clarity; describe the water in the wetland with regard to colour, clarity and suspended material, accounting for each observation. A Clarity Tube can also be used, this is a tool developed by GroundTruth to measure clarity (http://www.groundtruth.co.za/equipment/clarity-tube.html).

5. WETLAND SOIL PUDDLING (See diagrams below)

Farmers and other people interested in the soil sometimes use a simple puddling test to sample the soil. In this activity:

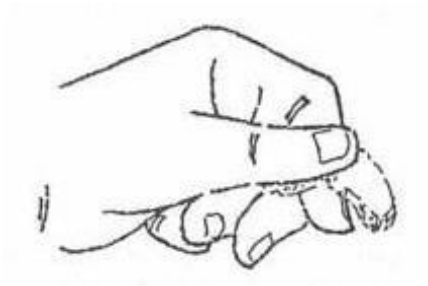
- Each learner takes a small handful of soil / mud
- If the material is dry the learner closes her fist over the sample and plunges her hand into a bucket of water to wet the sample. She removes her fist and squeezes excess moisture out of the sample.

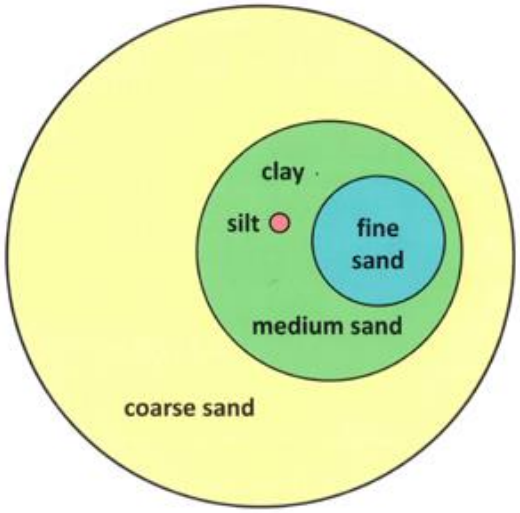
Puddling the sample (With educator's guidance)

To get an idea of the sand, silt and clay content gently rub the sample between thumb and forefinger.

- If the sample is sticky this tells you that there is clay.
- If you can feel slippery parts this shows the presence of silt.
- The gritty parts of the sample show the presence of sand.
- Try rolling the sample into a 'sausage'. If this is possible try bending it around to make a circle. If the sample is able to roll easily and bend then this shows it has a high percentage of clay.

Rub the sample between thumb and forefinger	Rolling the sample to make a "sausage"





The learners record their findings in the Records table.

Sand-sized particles are about the size of sugar crystals, silt particles are about the size of fine flour and clay particles are tiny – about the size of talcum powder.

6. HABITATS MAKE HAPPY HOMES

Apart from the water itself look for other animal habitats in the stream. Encourage the learners to look for logs, reed stems and rocks which might provide habitats for animals.

7. NATURAL VEGETATION

Using the Record table as a guide the learners should take note of the plant life. Noting some general classifications of vegetation. For example - away from the streams edge: “trees”, “thick bushes”, “tall grass” and “short grass” - close to the stream: reeds and bulrushes; and in the stream: reeds, water lilies and green algae.

- In the sheltered valleys of the hills above the wetland
- Some 50 metres from the stream
- At the edge of the wetland
- In the water of the wetland stream (Floating and submerged plants)

8. THE WETLAND ANIMALS

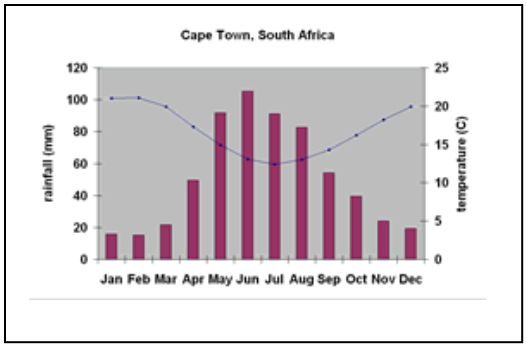
Using the Record table as a guide the learners should take note of the animal life that they might encounter. If not seen or heard the learners should look for signs such as birds’ nests and tracks of mammals or crabs in the mud.

- If the learner does not know the name of the animal she should make up one of her own.

BACK IN THE CLASSROOM

Weather patterns in your study area.

The flow of the river will be affected by the local climate. If your school is in a winter rainfall area (eg. Cape Town), the wetland will be in a different condition to one in a summer rainfall area (eg. Johannesburg).



- For climate data for your nearest large town go to https://en.wikipedia.org/wiki/Climate_of_South_Africa (Temperatures) and Rainfall for any location in South Africa go to: www.samsamwater.com/climate
- For details of the expected weather on any one day go to the website of the SA Weather Service: http://www.weathersa.co.za/city-pages/

REPORT: SCOPING THE WETLAND ENVIRONMENT

Wherever possible teachers should make suitable reference books relating to the fieldwork relating to the field work. Some examples may be found in Appendix E. The internet is also a useful source of information. Where learners have this access they should be encouraged to refer to this very useful source.

REPORT

The following is an example of instructions that you might give to your learners. Why not adapt the questions to suit your situation?

1. Write your own understanding (definition) of environmental scoping.
2. In a paragraph say what you have learned about environmental scoping as a tool for finding out about the ecological environment of a place.
3. Using the Internet or other sources of information, choose an animal species that interests you and prepare a short report that will include the following:
   a) Your reason for choosing this animal
   b) A description of the animal. (Appearance, behaviour - Include a sketch if possible)
   c) The ecological niche that it occupies
   d) It's sources of food
   e) Threats it faces in its daily life
   f) Suggestions regarding the conservation of the species.

MY WETLAND FIELDWORK RECORDS:
Scoping the wetland environment.

Follows on the next page

Our Group name: …… My class ……

My name: ……..

MY WETLAND FIELDWORK RECORDS: Scoping the wetland environment (One set per learner.)

MY NOTES: WHAT I LEARNED TODAY

IN THE CLASSROOM

Mapwork (In the classroom)

The coordinates for the centre of the wetland being studied are:

……°……'' South ……°……'' East

Topographic features related to wetlands. Use the map key to find the following conventional signs: (Use the correct colour OR write the name of the colour below the symbol)

Feature	Symbol	Feature	Symbol
"Marsh (swamp)"		Perennial streams"	
Land subject to controlled inundation"		Intermittent stream"	
Large wash (a mass of alluvial material transported and deposited by a river during flooding.)		Rapids	
"Submerged Marsh"			

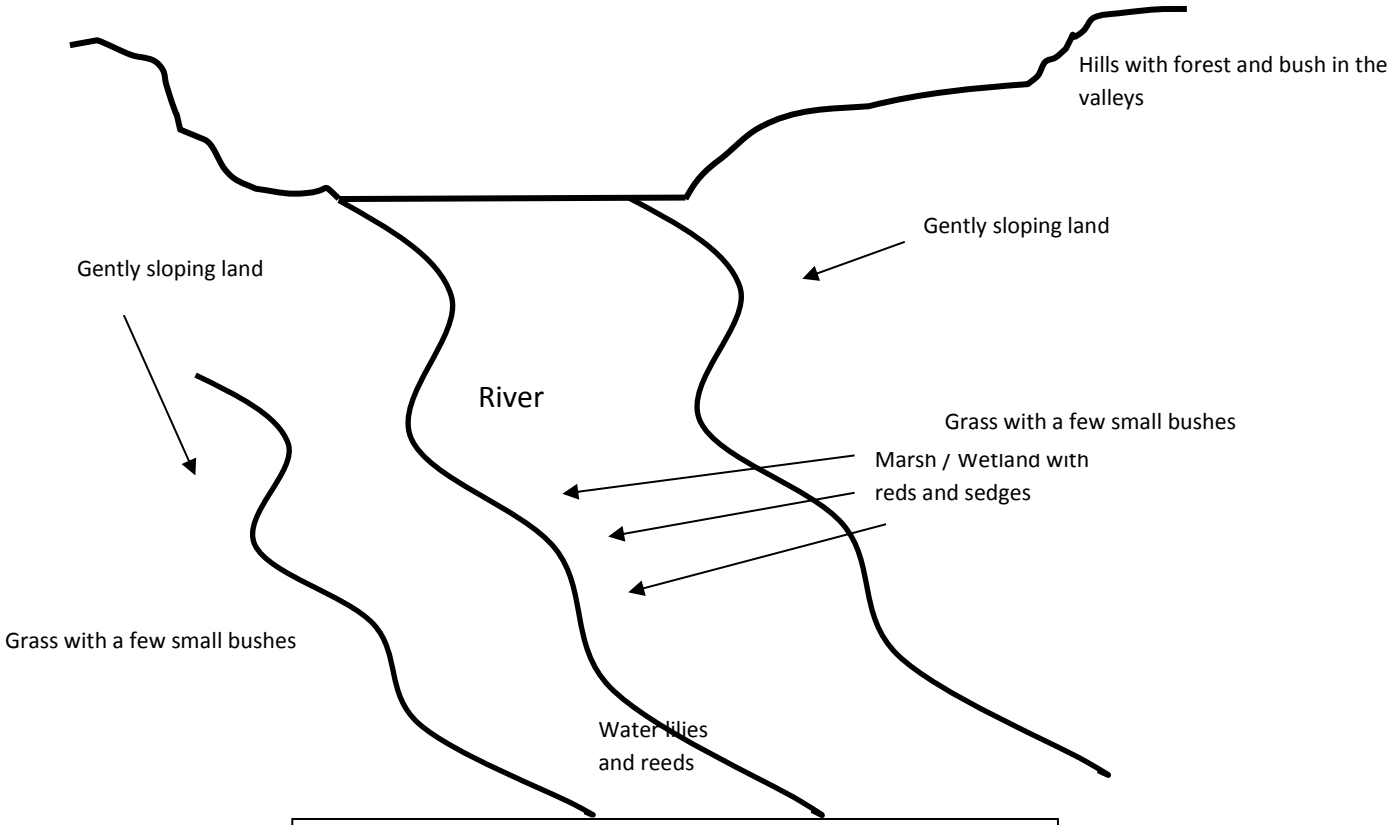
The distance from the wetland to the next river confluence is …… metres.

AT THE WETLAND (Looking and feeling to find out more)

Standing at a place where you can comfortably see the wetland and the area around it.

1. Field sketch

Sketch the area that you can. Keep your drawing very simple just highlighting the main features as in the example on the next page. Use this sketch to add any notes as your fieldwork progresses.



An example of a fieldwork sketch-map (keeping it simple)

2. Notes on the weather

Air temperature: Use a thermometer to measure the air temperature about 2 m above the ground.
Record it here: ……

Air humidity: If you have a hygrometer (a wet and dry bulb thermometer), measure the relative humidity. How much moisture is there in the air compared to what it could hold if saturated? (E.g. RH= 50% The air is half to being saturated).

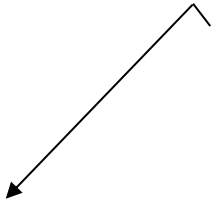
…….. %

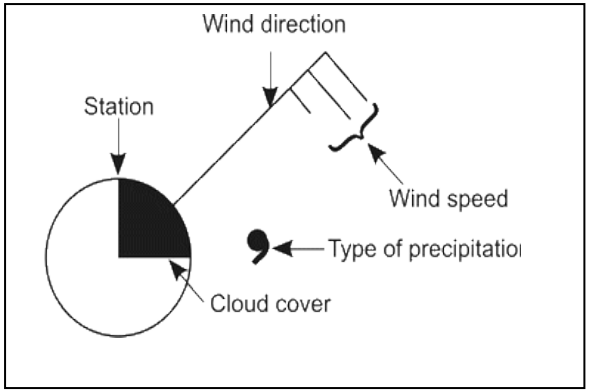
Use the circle to show the cloud cover. See notes below.	If clouds are present - name them (There may be more than one type).	Explanation the presence/absence of clouds. If you have measured the Relative Humidity of the air refer to this measurement in your explanation. RH = …… %

Wind.

Use an arrow to show the wind in terms of the direction from which it is blowing (the arrow) and its strength (the 'feather' on the arrow). One 'feather' = 1 knot. Refer to the Wind Speed scale to add the 'feathers' to the diagram.

For example, a wind from the NW. Strength of 1 on the Beaufort Scale





Draw your own Weather Station diagram here

3. Notes on the local geology	Find a rock in the study area. Describe its general colour and comment on its crystalline structure.	
	What is the origin of the rocks you can see? (Clues: Igneous rocks have a crystalline structure without layers; sedimentary rocks show layers.)	
4. Soil puddling: An investigation of soil structure	At the edge of the wetland:	50 metres from the wetland.
	From your observations of the plant-life (recorded below) how do you think the soil texture has affected the species of plants in the wetland?	
5. Natural vegetation In a few sentences describe the vegetation in general terms. Draw pictures if you prefer. If you don't know the names of the plants, give them a name of your choosing.	In the sheltered valleys of the hills above the wetland	
	50 metres from the wetland	
	At the edge of the wetland	
	In the water of the wetland stream (Floating and submerged plants)	

6. Notes on the stream bed and the water in the stream	The stream bed: Is the stream bed sandy with few rocks or rocky with many rocks? Two different habitats may affect the number of animal species.
	Using your Water Clarity Disk to measure its clarity, describe the water in the wetland with regard to colour, clarity and suspended material, accounting for each observation.
7. Habitats make happy homes (apart from the water itself look for other animal habitats in the stream) - It should be noted that the learners may not find all of the different habitats in one wetland	Are there any logs or other objects that might provide habitats for water animals?

8. The wetland animals

If not seen or heard, look for signs such as birds' nests and tracks of mammals or crabs in the mud.

If you don't know the name of the animal, make up one of your own.

Habitat (The place in nature that an animal can call home)	Examples of species
In the forested valleys:	
In the grassland:	
In the reeds:	
In the wetland next to the open water:	
On the water surface:	
Below water habitats:	

MY WETLAND REPORT

Use the following two headings for your report:

1) Scoping the wetland environment

   What is scoping? (Write a paragraph saying what this fieldwork technique involves and how you used environmental scoping to get an overview (big picture) of the wetland environment

2) Using the Internet or other sources of information choose an animal species that interests you and prepare a short report that will include the following:
   a) Your reason for choosing this animal
   b) A description of the animal (Appearance, behaviour - Include a sketch if possible)
   c) The ecological niche that it occupies
   d) It's source of food
   e) Threats it faces in its daily life
   f) Suggestions regarding the conservation of the species.

Class: …….. Learner's Name ……..

Model Lesson Plan: The Wetland Biosphere

(Scoping the wetland environment)

Example of a Rubric for assessing the learner's performance

The Assessment will be based on observations of learner participation in the field as well as on an assessment of the "**Scoping the wetland environment"** individual recording sheets.

SUGGESTED RUBRICS (Place the mark in the appropriate box)					
Learning Outcome used in the lesson In the table the use of his/her gender descriptions are inter-changeable.	5 Marks: Meritorious achievement expected for the grade	4 Marks: Substantial achievement expected for the grade.	3 Marks: Adequate achievement expected for the grade.	2 Marks: Elementary achievement for this grade	1 Mark: Not achieved
1. The learner completes the sections on map-work neatly and accurately.					
2. The learner completes the sections on geology and soils and shows an understanding of their contribution to the ecology of the wetland ecosystem.					
3 The learner understands and completes the section on the weather for the day and is able to observe and record the required weather elements.					
4. The learner completes the sections on vegetation and shows an understanding of their contribution to the ecology of the wetland ecosystem					
5. The learner completes the sections on wetland animals and shows an understanding of their contribution to the ecology of the wetland ecosystem					
6. The learner completes the report and is able to research and report on a selected wetland animal					
TOTAL OF MARKS (OUT OF 30)					

WRC: Project No. K5/2350

Geography: CAPS Further Education & Training Phase
Model Fieldwork Lesson Plan for Grade 10 Fieldwork
What makes a wetland a wetland? Why are wetlands strategically important resources?

Geography	**Grade 10: Geographical fieldwork – Wetlands and Water Security**
Duration: 2 hours	**Term 4: Topic Water Resources: Water management in South Africa** **Lesson focus: What makes a wetland a wetland?**

THE AIM OF THIS FIELDWORK STUDY

The aim of this field-work study is to encourage and promote insights into the strategic importance of South Africa's wetlands

The objectives of the study include improved understandings with regard to:

- The environmental (ecological) conditions that create wetlands
- The contribution of wetlands with regards to water security in the river basins that they are part of
- The role of wetlands in reducing the impact of abnormal rainfalls
- The critical importance of community involvement with regards to the management and conservation of local wetlands.

THE CURRICULUM CONTEXT

The Geography Curriculum

Appendix Two of this document lists important guidelines for effective Geography teaching and learning. Why not refresh your memory on these before reading further?

Section 2.2.4 Asking Geographical questions (Starting with the end in sight)

The Geography curriculum offers good advice when it comes to preparing for fieldwork activities. The table below offers suggestions with regard to the approach to fieldwork.

Why not work with a colleague to see how this approach might work in terms of fieldwork in general. As you go through the table, also consider the challenges facing fieldwork (in general) at your school and start to consider how these may be improved.

ASKING GEOGRAPHICAL QUESTIONS		
Method of enquiry	Key questions	Concepts
Observation	• What is it? • What is it like? • Who or what is affected?	Physical and human processes, awareness, perception, characteristics, similarities and differences.
Description	• Where does it occur? • Why is it there?	Location, place, region, space, distribution, pattern, scale and spatial association
Analysis and explanation	• What happened or is happening? • Why did it happen? • How is it changing?	Interdependence, causes and processes
Evaluation and prediction	• What are the effects? • What is likely to happen?	Environmental impact, social impact, interdependence, spatial interaction, spatial organisation, human-environment interaction, cause, process, time, behaviour, consequence, justice, quality of life, environmental quality, welfare, costs and benefits.
Decision making	• Who benefits? • What decisions must be made? • What are the costs and benefits of decisions? • How should it be managed? •	Choices, decisions, costs and benefits, planning, management, power, inequality and problem-solving.
Personal evaluation, judgment and Response	• What is my position? • What action can I take?	Cultural sensitivity, diversity, ethics, opinion forming, empathy, values, action and personal responsibility

WRC: Project No. K5/2350

INTEGRATION WITH OTHER CURRICULA

Extracts from the curricula of other FET learning areas that provide links with Geography

The table in the previous section illustrates the importance of SIX processes in fieldwork. In preparing fieldwork at a local level, it is wise to consider the support being given by other school curricula in support of these processes.

Languages (A selection of aims of particular reference to Geography fieldwork)
Learning a language should enable learners to:

- Use language appropriately, taking into account audience, purpose and context
- Use language and their imagination to find out more about themselves and the world around them. This will enable them to express their experiences and findings about the world orally and in writing
- Use language to access and manage information for learning across the curriculum and in a wide range of other contexts
- Use language as a means for critical and creative thinking, for expressing their opinions on ethical issues and values, for interacting critically with a wide range of texts

Life Sciences (A selection of aims of particular reference to Geography fieldwork)
By studying and learning about Life Sciences, learners will develop:

- Knowledge of key biological concepts, processes, systems and theories
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- An awareness of what it means to be a responsible citizen in terms of the environment and life-style choices that they make
- A level of academic and scientific literacy that enables them to read, talk about, write and think about biological processes, concepts and investigations.

Life Orientation (Two aims of particular reference to Geography fieldwork)
Life Orientation aims to:

- Guide and prepare learners to respond appropriately to life's responsibilities and opportunities
- Guide learners to make informed and responsible decisions about their own health and well-being and the health and well-being of others

Tourism (Two aims of Tourism that link with wetland fieldwork.)

- Mapwork
- Sustainable and responsible tourism, this relates in particular to the place of conservation with regard to eco-tourism. Wetland habitats as conserved areas are also areas of interest and importance to bird-watchers, botanists and others.

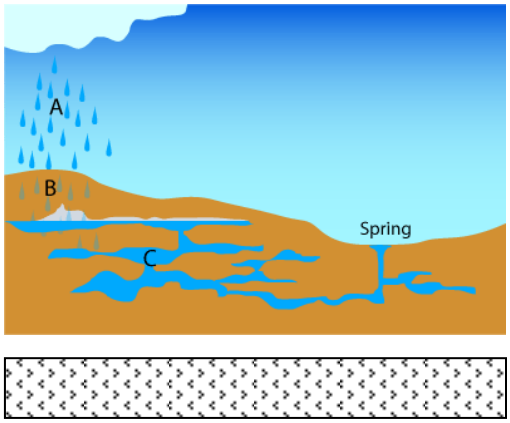
THE FIELDWORK

What makes a wetland a wetland? Why are wetlands strategically important resources?

Educators: During this fieldwork the learners will be asked to investigate the unique characteristics of wetlands and to discuss their strategic importance with regard to their dual functions of flood control and water security in South Africa.

Wetlands as ecosystems: A wetland is an area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem.

- Wetland ecosystems usually occur in low-lying or flat areas where river water is allowed to spread out.
- At the coast wetlands are found at the mouths of estuaries
- Away from the coastal areas wetlands usually form where the river flows slowly over gently sloping or flat land where the river spreads sideways and where occasional flooding floods the land on either side if the river.
- Wetlands may also occur where the underlying geology presents an impervious layer of rock so that the water cannot penetrate (commonly a sill of dolerite) rock. See diagram below.



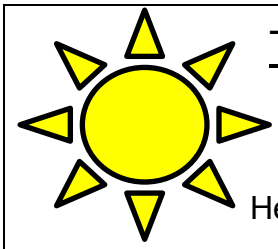
Rainwater percolates through cracks in the rock. The impervious layer prevents further flow and eventually emerges at the surface to create a spring or small flow of water. If the area is flat and water accumulates a wetland may form around the spring.

WHAT WILL WE NEED TO HELP US FIND ANSWERS? (Planning the work. Working the plan)

Prior knowledge:	**Looking forward:**	**Prior planning:**
From the Grade 9 studies of the biosphere, learners would have studied the elements of the biosphere: the lithosphere (soil and rocks), all living organisms (plants, animals and, microorganisms) and dead organic matter. Use a chalkboard summary diagram or print as a handout) of a part of a wetland ecosystem picture showing the sun, the air, the substrate (soil, mud), plants and animals. See example below.	The learners can look forward to finding out for themselves about the role of wetlands in the provision of the region's water supplies and in the control of flooding during times of high rainfall.	To plan the learning program it is essential that you visit the study area beforehand.

THE ECOLOGY OF A WETLAND

For a brief overview of wetland basics, visit: http://www.wetland.org.za/ckfinder/userfiles/files/2_1-



PREPARING FOR THE FIELDWORK: PLANNING AND RESOURCES

Success depends upon previous preparation, and without such preparation there is sure to be failure.

PLANNING

Using a chalk-board summary to explain how the fieldwork will be undertaken. Then help the learners to organize themselves into small groups (e.g. 4 – 6). Ask them to give their groups names that are appropriate to the research (e.g. *Water Wonders, The Otters; The Weavers).* In the home language of the learners if preferred.

FIELDWORK RESOURCES

The resources listed below are the minimum suggested for the fieldwork. If your school can access these they would add value to the fieldwork. For well-resourced schools, educators can also use a Google Earth image of the wetland together with the 1:50 000 topographic map.

FOR EACH GROUP:

A 1:50 000 topographic map on which the wetland appears. In July 2015 these maps were priced at R13.50 each. If you haven't already done, why not invest in a set? - One map for every 4-6 learners.

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1:50 000 Topographic Maps are easily available from: The Chief Directorate Surveys and Mapping. Van Der Sterr Bldg, Rhodes Ave, 7700, Mowbray, Cape Town, Western Cape, South Africa.
Phone Number: 021 6584300
NB: If your department has the resources each map can be supplied laminated at an additional cost of R27 per map.

FOR EACH LEARNER
RECORD KEEPING: *What makes a wetland a wetland? Why are wetlands strategically important resources?* One per learner

THE FIELDWORK INVESTIGATIONS: A GEOGRAPHICAL APPROACH

As discussed earlier the steps in the wetland investigation are in accordance with Section 2.2.4 of the FET Geography curriculum which lists six key questions that a Geographer can ask to ensure an effective investigation. These are questions relating to

1. Observation
2. Description
3. Analysis and explanation
4. Evaluation and prediction
5. Decision-making
6. Personal evaluation, judgment and response

To this list of six we can add an introductory step - that of ORIENTATION. Since Geography is essentially a study of PLACE all geography studies should be located at particular sites (places).

MAPWORK ORIENTATION

In the classroom: Orientation (The exact location of the wetland)

What to do

- Divide the class into convenient chat-groups (e.g. 4)
- What you will need per group of learners:
  - 1:50 000 Topographic map (To find out how to purchase the map for your area go to Section E - Useful Explanations, E-References & Appendixes)
  - Lengths of string (30cm)

Focusing on the 1:50 000 Topographic map

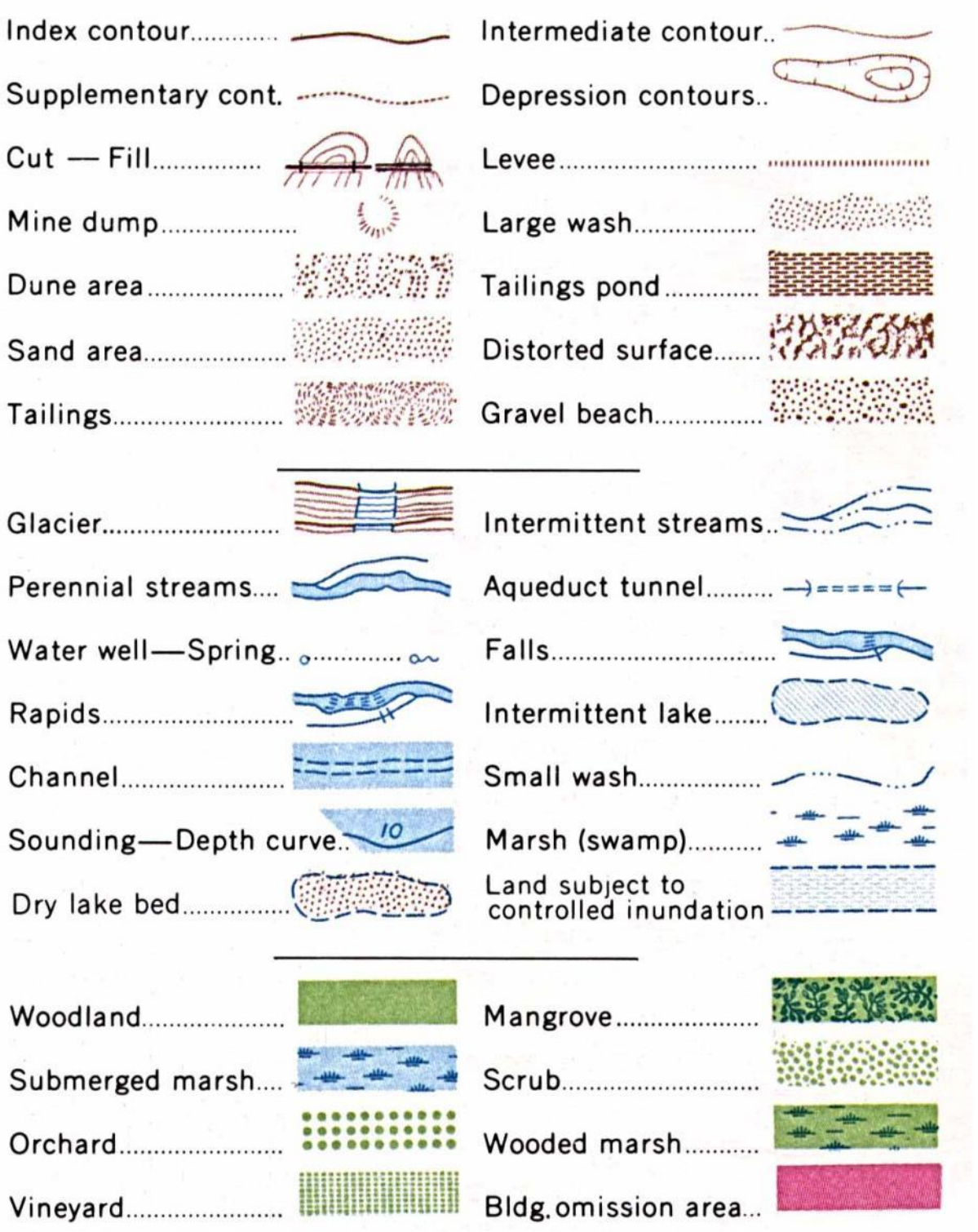
- Referring to the topographic map key on the next page ask the learners to find the coordinates for the centre of the wetland study area.
- In small group discussions ask the learners to find out more about the Map Symbols used to show:
  - A wetland: “Marsh (swamp)” in the key
  - Land subject to controlled inundation
  - A “Large wash’’ (a mass of alluvial material transported and deposited by a river during flooding)

The learners should then record their findings in the ***My Fieldwork Records*** recording sheet.

Fieldwork site
The learners should find the exact site (position) of the wetland on the topographic map. Ask the learners to check the drainage basin to which the river belongs, naming the river basins that are further downstream. Using the piece of string as a measuring device the learners must then measure the distance from the wetland to the next river confluence.

The learners must enter the information on the ***My Fieldwork Records*** sheet

1:50 000 Topographic Map KEY



THE FIELDWORK: WHAT MAKES A WETLAND A WETLAND? (OBSERVATION AND DESCRIPTION)

At the wetland - Ecological Investigation: The Substrate

Observing and describing the wetland substrate: The soil and mud in the wetland

You will need a bucket of clean water handy so that the learners can rinse their hands from time to time.

This simple experiment will help the learners compare the **sand, silt and clay** content of TWO soil samples – one from the wetland and the other a distance from it.

What you will need:

- Two plastic or glass jars / bottles with screw tops with the labels removed (e.g. peanut butter jar) - Two jars per group.
- Plastic rulers - one ruler per group.

The Soil Shake Investigation (See diagram on the next page)

- Divide the class into convenient chat-groups (e.g. 4)
- Give each group TWO jars – marked A and B (Use a label or mark with a koki pen)
- Each group is to sample two lots of soil:
  - One as close to the water's edge as possible (Sample A)
  - The second away from the wetland's edge. (Sample B)
- Each sample is placed it in the jar to a depth of about 1/3 of the jar
- Each jar is then topped up with water and the lid firmly replaced
- The water in each jar is shaken well for a few seconds until the contents are well mixed
- The jars are then placed on a steady surface (e.g. a log or stone) where they can be easily viewed
- While the class waits for the mixtures to settle they can go on to the next activity (Mud puddling)

Wetland Puddling (Soil or mud) (See diagrams below)

Farmers and other people interested in the soil sometimes use a simple puddling test to sample the wetland soil / mud. In this activity

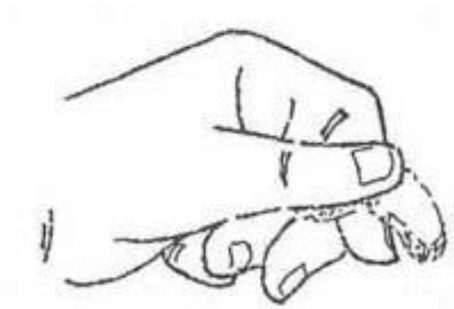
- Each learner takes a small handful of soil / mud
- If the material is dry the learner closes her fist over the sample and plunges her hand into a bucket of water to wet the sample. She removes her fist and squeezes excess moisture out of the sample.

Puddling the sample (With educator's guidance)

To get an idea of the sand, silt and clay content gently rub the sample between thumb and forefinger.

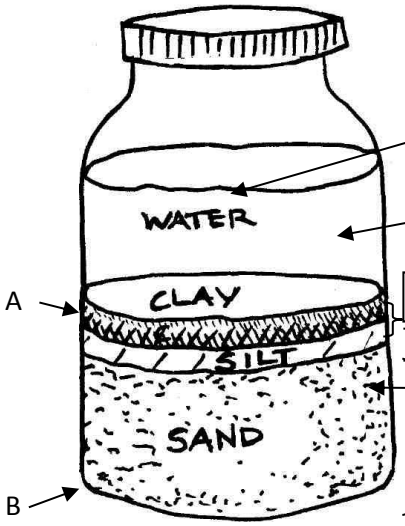
- If the sample is sticky this tells you that there is clay
- If you can feel slippery parts this shows the presence of silt
- The gritty parts of the sample show the presence of sand
- Try rolling the sample into a 'sausage'. If this is possible try bending it around to make a circle
  If the sample is able to roll easily and bend then this shows it has a high percentage of clay

Rub the sample between thumb and



Rolling the sample to make a “sausage”

THE SOIL / MUD-SHAKE INVESTIGATION



Organic matter floating on the surface

Muddy water shows the presence of clay suspended in the water. The smallest particles may take weeks to settle

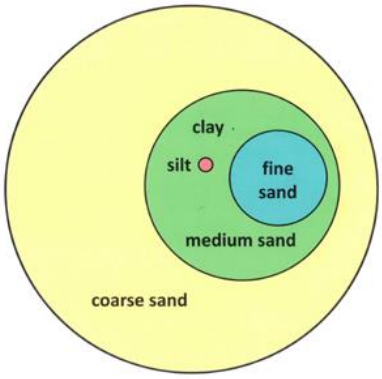
There may be different grades of sand ranging from coarse to relatively fine

Sand-sized particles are about the size of sugar crystals; silt particles are about the size of fine flour and clay particles are tiny – about the size of talcum powder

What’s in the soil? How important is each part? (Initial discussion with educator)

- The organic material (pieces of leaves, sticks) floating on the top indicates the presence of organic matter in soil.

Soils have different amounts of sand, silt and clay.



Sand sized particles allow air into the soil. This is important for soil organisms such as bacteria, fungi, protozoa, nematodes, arthropods and earthworms – all of which are essential parts of the soil’s ecology.

Silt sized particles (just bigger than a pin-head) help the soil structure to support plants.

Clay sized particle (smaller than a dot on this page) also provide structure but they are most important because they hold the nutrients that the plant needs (Nitrogen, Potassium, Phosphate and other plant foods).

Assessing the relative percentages of each particle size (Educator to demonstrate with one example from the class)

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To calculate the relative percentages of sand, silt and clay in the diagram above:

1. Measure the total distance from A to B (e.g. 70 mm)
2. Measure the thickness of each layer (e.g. Clay 20 mm; Silt 16 mm and Sand 34 mm. Total = 70mm)
3. To calculate the % for Sand 34 ÷ 70 X 100 = 48 % (Rounded)
4. To calculate the % for Silt 16 ÷ 70 X 100 = 23 % (Rounded)
5. To calculate the % for Clay 20 ÷ 70 X 100 = 29 % (Rounded)

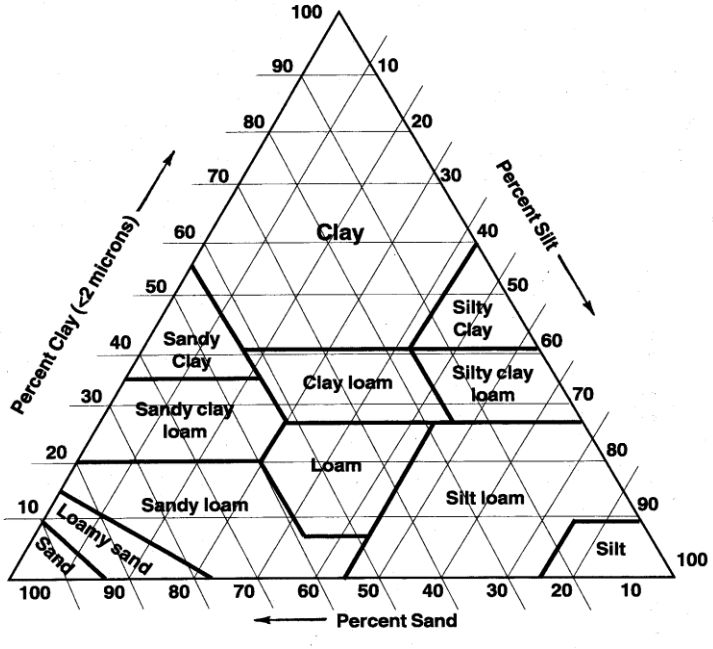
100%

Naming of soil types: The soil triangle

Soil scientists give names to soil types with various proportions of sand, silt and clay. The soil texture triangle is a convenient way of finding the names of soil types.

Why not print and laminate the triangle – one copy per group?

To familiarize the learners with the soil triangle ask the learners:



How many categories of soil are there?

……

How many soils have a relatively large sand content?

……..

How many have a relatively large clay content?

…….

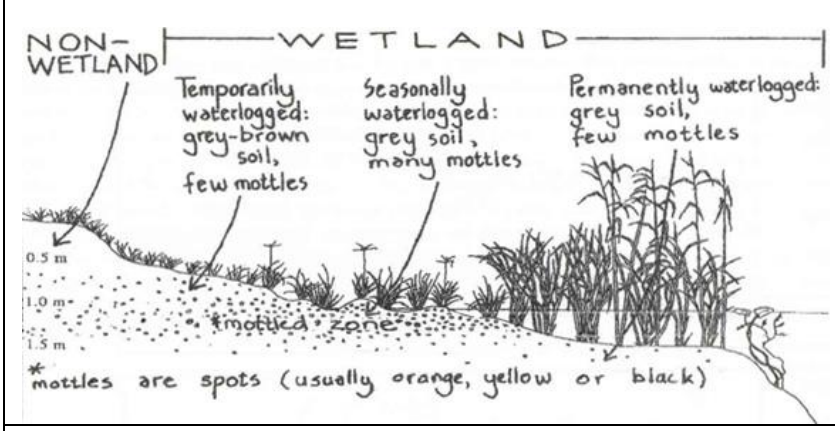
How many soils have a good balance for crop farming – between sand, silt and clay?

……..……..……

FIELD OBSERVATION ARE IMPORTANT

Soil colour also indicates clay content

Dark brown or black colours in soil indicate that the soil has a high organic matter content. Wet soil will appear darker than dry soil. In South Africa most wetland soils are dark colour because of these two factor



Gley soils – Additional indicators of wetland soils

Wetlands often have gley (or gleyed) soils. These are mottled soils showing spots of orange, yellow or black, that have formed under conditions of poor drainage, resulting in a chemical reaction affecting the iron compounds in the wetland soil.

Discussion of the wetland soils/ mud

The learners enter their observations and findings in the "My Fieldwork Records" table.

At the wetland - Ecological Investigation: Plant life

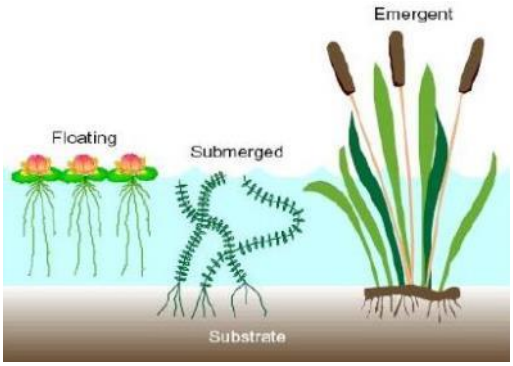
Observing and describing the indicator species of plant-life in the wetland

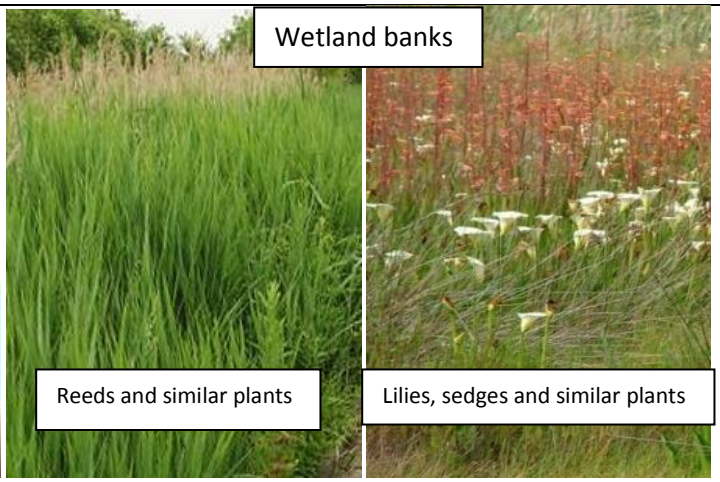
Habitats make happy homes

Before any discussions on plant and animal life in a wetland, revise with the learners the concept of 'habitat' (Get their memories of it before assisting). For Example: *A habitat is the natural home of an animal, plant or other organism; it is a place in the environment where a species can live.*

Wetlands as plant habitats

Certain species of plants will only grow in wetlands. Allow the learners 30 minutes to look for and record in their *fieldwork record sheets* (example attached at the end of these notes). Examples of these indicator species for each of the five categories given below. Examples for educator information only. The learners will make their own observations as discussed below on the next page.





Floating plants; Submerged plants; Emergent plants; Wetland bank plants. Refer to Appendix One: Water plants as indicator species of wetlands.)

There are two broad categories of wetland plants

- Plants that grow in the water itself (floating, submerged or emergent)
- Wetland plants that grow in soil that is permanently wet or which stays wet in the rainy season (Reeds, sedges, lilies etc.).

In preparing for the fieldwork the educator should identify as many different plant species as possible. Scientific names are not necessary, but wherever possible commonly used names should be applied (English as well as vernacular) - e.g. In the water: Reeds, water lilies, green algae, bulrush, At the water's edge: Sedge, bulrush, and arum lily.

- The learners should choose at least three plants growing in the water and three plants growing at the water's edge
- If the English names are not known to the group an appropriate English name should be chosen by the group.
- If a vernacular name is know it should be recorded.
- For each plant the learners should consult together to provide a way in which the plant is adapted to its habitat.
- Observations should be entered in the record sheet: "*My fieldwork record sheet*"

At the wetland - Ecological Investigation: Animal life

Observing and describing the indicator species of animals in the wetland

Wetlands as animal habitats

As with plants certain species of insects, arachnids, molluscs, reptiles, birds and mammals are also indicators of proximity to wetlands. Refer to Appendixes 2 and 3 for details.

Sampling the animal life

Ask the class to look for and give names to as many of each species as possible.

Allow each group 30 minutes to observe and record in the table provided as many species as possible. From actual sightings of animals or evidence such as tracks and droppings.

Instructions to be given:

Insects: Ask the learners to observe and/or find and record the insects.

Insects (Both in the water as nymphs or above the water as adults): Dragon flies, Mayflies, Damsel flies, Mosquitoes.

Choose the most appropriate key(s) for the wetland and Issue each group of learners with a key or keys. See Appendix Two.

- Above the water: Adult animals may be seen flying above the water
- In the water: The learners to collect a full container of stream water from the wetland and then sample the various habitats, carefully lift up rocks and branches to inspect them for insect larvae. Any animal that is found should be gently removed with the end of a pencil or stick and placed in the container of water.
- The learners to use the key(s) supplied to identify the animals they find.

Molluscs: Learners to record any snails they may see (live animals or shells).

Arachnids: Learners to observe, name (choose their own descriptive name if necessary) and record any spiders that they observe.

Reptiles: Evidence or sightings of water monitors (leguaans), snakes, lizards living in the wetland. Appendix Three

Birds: Observe, name and record any birds that have the wetland as a habitat – both spending time in the water and in the vegetation around the wetland. Appendix Three

Mammals: Evidence or sightings of field mice, rats, otters, water mongoose or other wetland species. Appendix Three

Wetlands, slow release of water and flood attenuation

At the wetland - Ecological Investigation: The benefits of wetlands

At the wetland, as final group work, ask the learners to consider the benefits of wetlands by providing them with the following headings:

1. The regulation of the flow of water in the stream below the wetland
2. The potential for wetlands to reduce the impact of heavy rains.

The learners should note their findings in the record sheet. These will be discussed as part of the follow-up work in the classroom.

Classroom Note-making and Action Steps

At the wetland - Ecological Investigation: Note-making

Note-making
Discuss the findings with the learners by referring back to your original chalkboard diagram and asking the learners to help you place examples of THEIR findings on the diagram.

- Discuss with the learners
  - The ecological role of wetlands in regulating the flow of water to streams and rivers below the wetland
  - The function of wetlands with regard to the slow release of water as a strategic resource for both the environment and for people.
  - The value of wetlands as conservation areas for indicator species of plants and animals
- Once done allow time for each learner to complete their Fieldwork Record Sheets.

Taking action

- Ask the learners for their ideas regarding improving community awareness of the importance of wetland conservation. Sources of water, conservation of species, soil conservation, places for school fieldwork, etc.
- Using this information the learners must now design a poster that will encourage their community to protect the local wetland. The poster should show the diversity of life in a wetland and indicate what ecological services the wetland provides (they can work individually or in their groups).

MY WETLAND FIELDWORK RECORDS:

What makes a wetland a wetland? Why are wetlands strategically important resources?

Follows on the next page

My name: ……. **Class: ……..**

MY WETLAND FIELDWORK RECORDS: ***What makes a wetland a wetland? Why are wetlands strategically important resources?***

<table>
<tr><th></th><th colspan="2">MY NOTES: WHAT I LEARNED TODAY</th></tr>
<tr><td rowspan="5">Mapwork</td><td colspan="2">The coordinates for the wetland being studied are:
South: …… East: ……</td></tr>
<tr><td>Topographic features related to wetlands</td><td>Symbol</td></tr>
<tr><td>Map symbol for a “Marsh”:</td><td></td></tr>
<tr><td>Map symbol for “Land subject to controlled inundation”</td><td></td></tr>
<tr><td>Map symbol for a “Large wash’’ (a mass of alluvial material transported and deposited by a river during flooding.)</td><td></td></tr>
<tr><td>The water in a wetland</td><td colspan="2">Describe the water in the wetland with regard to colour, clarity and suspended material, accounting for each observation.</td></tr>
<tr><td rowspan="3">Observation & Description:

Wetland Soils</td><td colspan="2">Colour:</td></tr>
<tr><td colspan="2">Texture: Describe and use the soil triangle to give the wetland soil a name.</td></tr>
<tr><td colspan="2">Other observations:</td></tr>
</table>

Observation & Description: **Plants**	Floating plants:	
	Submerged plants:	
	Emergent plants	
	Wetland banks:	
Observation and Description: **Animals** If not seen or heard, look for signs such as nests of birds or tracks of mammals or crabs in the mud.	Species (Seen or found signs of – spoor, droppings feathers, etc.)	Adaptation to the wetland habitat (How living in or near the wetland benefits the animal)
	Insects: Larvae	
	Insects: Adults	
	Arachnids	
	Birds: Spending time on the water	
	Birds: Spending time above the water or in the wetland vegetation.	
	Mammals	
	Reptiles	

THE IMPORTANCE OF WETLANDS

On a separate sheet of paper make a sound case for prioritizing the protection of wetlands using the following headings:

a) **The role of wetlands in the functioning of riverine ecosystems**
b) **The potential of wetlands for ecotourism**
c) **The critically important contribution that wetlands make to the South African economy**

Class: …….. Learner's Name ……..

Model Lesson Plan: *The Wetland Biosphere*

(*What makes a wetland a wetland? Why are wetlands strategically important resources?)*

Example of a Rubric for assessing the learner's performance

The Assessment will be based on observations of learner participation in the field as well as on an assessment of the "*My Wetland Fieldwork Records"* individual recording sheets.

SUGGESTED RUBRICS (Place the mark in the appropriate box)					
Learning Outcome used in the lesson In the table the use of his/her gender descriptions are inter-changeable.	5 Marks: Meritorious achievement expected for the grade	4 Marks: Substantial achievement expected for the grade.	3 Marks: Adequate achievement expected for the grade.	2 Marks: Elementary achievement for this grade	1 Mark: Not achieved
1. The learner participates well in using the topographic map to locate the fieldwork area.					
2. The learner participates well in the soil investigations and recognizes the four soil components of: humus (organic matter), clay, silt and sand.					
3. The learner chooses names and describes at least 3 wetland plants.					
4. The learner is able to explain the ecological role of the wetland plants identified.					
5. The learner is able to use simple identification keys to identify and record 3 wetland animal species					
6. The learner is able to explain the ecological role of the wetland plants identified					
7. The learner is able to present a sound argument for the conservation of South Africa's wetlands.					
8. The learner demonstrates through the poster picture an understanding of the strategic importance of the wetland biosphere.					
TOTAL OF MARKS (OUT OF 40)					

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