SECONDARY SCHOOL STORMWATER

NCEA RESOURCES

EDUCATION FOR SUSTAINABILITY (EFS)

Auckland Council
Te Kaunihera o Tāmaki Makaurau

CONTENTS

This resource has editable sections for you to customise for your students.

Auckland schools are invited to contact Auckland Council for further support.

Email: efs.administration@aucklandcouncil.govt.nz
Visit: aucklandcouncil.govt.nz/educationforsustainability

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

INTRODUCTION AND LEARNING PLAN

INTRODUCTION

What is stormwater?

Stormwater is rain water that flows across the ground and does not get absorbed into the soil. It flows into stormwater pipes, then into streams, and from there into estuaries and the sea.

The way the region manages its stormwater, particularly as it grows, will determine the quality and health of our freshwater and marine environment. One new person arrives in Auckland approximately every twelve minutes. Auckland is expected to have a population of 2 million people by 2030.

What are some stormwater management issues in Auckland today?

- Stormwater run-off adversely affects Auckland's urban streams.
- Stormwater contaminants are accumulating in estuaries and enclosed harbours.
- Land development and soakage adversely affect groundwater aquifers.
- Flooding can have a major impact on stormwater quality as it can cause erosion.

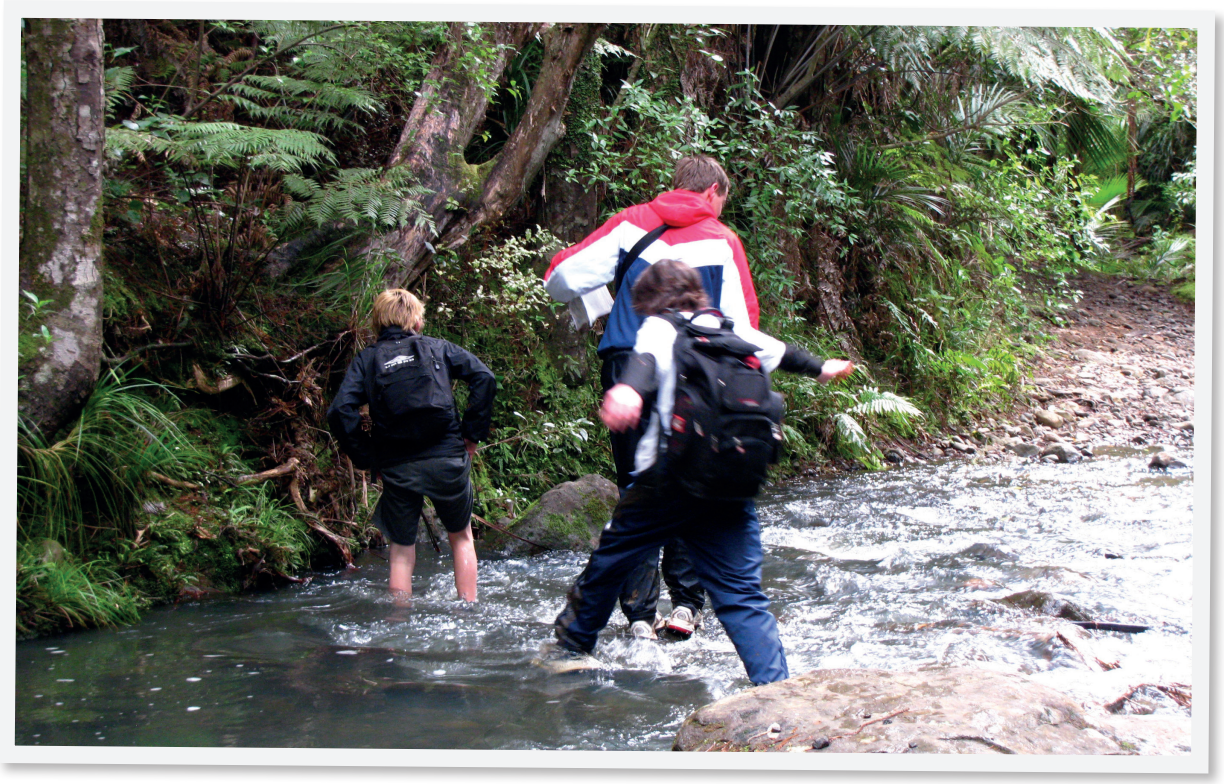
Why develop assessment tasks for secondary schools?

Auckland Council has produced this resource to work in partnership with schools and with the local community to help reduce the impact of stormwater on water quality in the region. These assessment tasks and activities, which have been trialed in Auckland secondary schools, provide a context for learning that engages students with their local communities and provides opportunities for in-depth learning that can result in students gaining several achievement standards. Teachers can choose one part to teach or can use stormwater or the stream as a context for developing scientific monitoring. This will allow students to use the data to inform action for the local environment. Students can also use their experience to explore different values around stormwater and develop this through to level 3, with continued action and/or working with organisations for strategic planning and long-term scientific monitoring.

The learning program has been based around developing action competence for sustainability.

nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability

Action competence here is defined as students having the ability and willingness to take action on issues regarding stormwater and sustainability that interest them. We hope that you enjoy using this resource.



WHAT'S IN THIS RESOURCE?

Learning plan:
A programme of learning/a course outline for level 2 and level 3 NCEA qualifications.

Assessment resources:
Four assessment resources for the Education for Sustainability achievement standards. This resource has editable sections for you to customise for your students.

Level 2			
AS 90810	**EfS 2.1 Storming the Waters! Stormwater action.** Undertake a personal action, with reflection, that contributes to a sustainable future.	6 credits	Internal
AS 90811	**EfS 2.2 Stormy Waters – The science of stormwater.** Explain how human activity in a biophysical environment has consequences for a sustainable future.	4 credits	Internal
AS 90813	**EfS 2.3 What's up in my stream?** Demonstrate understanding of how different personal values have implications for a sustainable future.	3 credits	Internal

Level 3			
AS 90832	**EfS 3.5 Stormwater Strategy- Stepping up for Stormwater.** Develop a strategy for an organisation that will contribute to a sustainable future.	5 credits	Internal

The Education for Sustainability (EfS) standards are integrated across all learning areas. They are on the NZQA framework and are part of the approved subject list.

nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/education-for-sustainability/levels

EfS standards can be included in a range of different courses or can be added to students' learning programmes where appropriate assessment can be part of in-depth study or extra curricula action. The standards, which were developed in 2008 have been aligned. They sit in the sub-field of science.

The senior secondary guidelines are on Te Kete Ipurangi (TKI):

seniorsecondary.tki.org.nz/Social-sciences/Education-for-sustainability

Ideas for a junior programme:

This resource also supports teachers of Year 9 and Year 10 classes planning to use stormwater as a context. It helps engage in science and develops understanding and skills on an authentic issue in their own community. The programme scaffolds learning to support sustainability topics in the senior school and provides links to topic outlines and resources.

efs.tki.org.nz

Resources and support materials:

These can be used to support your programme.

How does this resource support the key competencies of the New Zealand Curriculum?

Action competence supports the development of the key competencies of the New Zealand Curriculum through the process of taking action.
In Education for Sustainability the six aspects listed below have been identified through research in New Zealand schools to support the development of student action competence.

(See: tlri.org.nz/tlri-research/research-completed/school-sector/investigating-relationship-between-whole-school)

Experience: E.g. visiting local streams and stormwater outlets and working to gather data.

Reflection: E.g. incorporating reflective learning strategies associated with experience and learning.

Knowledge: E.g. focusing on EfS concepts and scientific ideas.

Vision: E.g. providing opportunities for the student to think of their community in the next ten (or forty) years.

Action: E.g. assessment opportunities for students to plan and implement actions to reduce stormwater run-off.

Connections: E.g. deliberate teaching to make links between people and the environment, knowledge and action, attitudes and responsibility.

Contacts for support or further information

Auckland schools are invited to contact Auckland Council about further support.
Email: efs.administration@aucklandcouncil.govt.nz
Visit: aucklandcouncil.govt.nz/educationforsustainability

LEARNING PLAN

Teacher rationale

This document provides a learning plan for the NCEA assessments in this resource. For more details see the NZQA link below.

nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/education-for-sustainability/levels/

Both AS 90811 (EfS 2.2) and AS 90810 (EfS 2.1) could be done by a level 2 class in either a sustainable futures class, environmental science or geography. Students can use the scientific data from the EfS 2.2 assessment to inform the action of EfS 2.1. In both standards it is important for students to develop an understanding of 'sustainability' and the interdependence of the aspects of society, culture and economics with the environment.

Alternatively, each assessment could be done in different subjects in a cross disciplinary context, for example a film about the human consequences on a local stream for media studies to inform the community, or a speech in English to lobby support and action from the community for the stream, informed by data gathered in biology.

Students need to link the scientific data in the stream investigation to the future of the ecosystem, catchment, harbour and community. For the action standard, students will need to experience taking action and practice planning and evaluating. There is also opportunity at level 3 AS 90832 (EfS 3.5) to develop their action and their research in the biophysical environment by working with another stakeholder.

The learning experiences provided are just suggestions so these can be used in any order for any of the assessments or however is appropriate for your students. It is advised that students experience a range of reflective practice and cooperative strategies, as well as experiences in the environment and exposure to actions for sustainability. Some of the learning experiences for each standard overlap but there are specific learning outcomes for each standard. Teachers could use the context of stormwater for a range of learning experiences and then provide options for assessment opportunities.

Work on stormwater, stream monitoring and actions for sustainability could easily be linked to other NCEA assessments, for example in science, biology, geography, technology and media studies. See the EfS teaching and learning guidelines at:

seniorsecondary.tki.org.nz/Social-sciences/Education-for-sustainability/Learning-programme-design

Key competencies

These are developed through the learning program and are denoted in green. For example EfS 2.2 provides:

Using language symbols and text, managing self, thinking, relating to others, and participating and contributing.

The sample unit plan overleaf will help you to develop your unit about the impact of human activity on stormwater in Auckland catchments and the effects on the Hauraki Gulf and Manukau Harbour to support the level 2 and 3 EfS assessment resources provided below.

Curriculum links: Principle – future focus of sustainability, citizenship.

Values: Ecological sustainability, innovation, inquiry and curiosity, community and partnership.

EFS: LEARNING PROGRAMME DESIGN

Sample unit plan for an integrated EfS programme

Education for Sustainability

How can rubbish recycling and composting be improved at our school? How can we preserve the aquatic ecosystem? Why is it important to create zones for biodiversity in urban areas? Do green businesses really make a profit?

History

How has human settlement affected the environmental quality of the catchment over time? What famous people have lived in the catchment area? What is the Māori view on how the land of the catchment was formed?

Health and physical education

What types of recreational activities are there around a waterway? How do people work best together to solve environmental problems?

Urban stream catchments: Drains or sustainable ecosystems?

Geography

What are the urban planning opportunities in response to increasing population? What type of substances do people pour into the stormwater system?

Science

What type of pollutants are entering the waterway?

How is water quality measured?

What types of native plants attract birds?

What are the best environmental conditions for growing plants?

What types and how many invertebrates live in the stream?

Mathematics and statistics

What is the area of land to be used?

What are the descriptive statistics and margins of error associated with biophysical water quality data?

How can we quantify the increase in biomass in a planted area?

CURRICULUM LEVEL 7

Education for Sustainability

Three level 2 NCEA assessment tasks are available as part of this resource.

Students will gain knowledge, skills, and experience to:

- investigate how to enhance and maintain biophysical systems and improve biodiversity
- investigate the aspects of sustainability in different contexts
- examine the values and behaviours that will contribute to a sustainable future
- plan, implement, and evaluate personal action for a sustainable future.

seniorsecondary.tki.org.nz/Social-sciences/Education-for-sustainability/Learning-objectives

Science

Nature of Science (NOS): Investigation in science, participating and contributing.

- **Living world:** Ecology – explain ecological distribution patterns and explain possible causes for these patterns.
- **Planet earth and beyond:** Earth systems and interacting systems.
- **Material world:** Apply knowledge of chemistry to explain aspects of the natural world.

Geography

- Understand how people's perceptions of and interactions with natural and cultural environments differ and have changed over time.

Technology

- Technological practice.

(Some lessons may take more than one period).

Learning intention	We are learning to use information to take meaningful action to reduce the impact of stormwater in our local environment.			Associated Achievement Standards
	EfS 2.1 Achievement Standard: 90810 Undertake a personal action, with reflection, that contributes to a sustainable future. Credits: 6 Internal Visit: nzqa.govt.nz/ncea/assessment/view-detailed.do?standardNumber=90810			Technology 2.1, 2.3, 2.1 (e.g. developing products or processes that don't leave chemicals in a stream – fertilisers/cleaners/ insecticides. Designing water collection, pollution traps). Geography 2.6 Media studies 2.6 Agriculture and horticulture 2.8
Key concepts	**Lesson outline**	**Possible learning experiences**	**Opportunities for students**	**Resources** Activities in **BOLD** are included in this resource
Responsibility Action orientation Informed decision making Guardianship/ kaitiakitanga Citizenship Regeneration Diversity	**1. Visit stream**	• Connect with the local environment and stream and explore the health of the place where students live. • Review stormwater impacts on the local stream and community. **Managing self**	• Experience their local stream and reflect on the meaning of the environment to themselves.	**Surface types and their effects on the environment** **Stormwater Aspects**
	2. Research stormwater as a sustainability issue	• Identify economic, social, cultural and environmental consequences or influences using 'aspects template' or 'consequence wheel.' • Discuss the relationship to a sustainable future; what are the options for stormwater in your community in 10 years and in 50 years? **Thinking**	• Describe each aspect of sustainability in relation to stormwater and develop understanding on how they relate to each other.	**Consequence wheel** efs.tki.org.nz/Curriculum-resources-and-tools/Consequence-Wheel **Aspects template** nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability/Tools-and-resources
	3. Investigate examples of stormwater actions	Visit examples of different actions to reduce stormwater impacts on the land, ecosystem, community and harbour. Visit a restored stream, local community project or explore the Project Twin Streams website activity.	• Realise that actions taken to improve stormwater into streams taken today affect the future.	Investigating Project Twin Streams **See Project Twin Streams case study** projecttwinstreams.com

Key concepts	Lesson outline	Possible learning experiences	Opportunities for students	Resources Activities in **BOLD** are included in this resource
Responsibility Action orientation Informed decision making Guardianship/ kaitiakitanga Citizenship Regeneration Diversity	**4. Take part in an action for sustainability**	• Work with your teacher or community group to model planning and taking action for sustainability with a fun class project e.g. take part in tree planting. **Relating to others**	• Research knowledge of the issue, its cause(s), and a range of possible ways of acting on this issue. • Practice skills needed for taking action.	**Possible stormwater actions** **Activity**
	5. Reflect on the experience and explore cooperative strategies	• Use the decision making grid to practice establishing criteria to evaluate action for a sustainable future. Did it make a difference? Why and why not? • Brainstorm a range of actions using the activity sheet and possible action sheet. Use data collected from investigations to inform action. **Participating and contributing**	• Trial evaluation tools and develop their understanding of a sustainable future.	**Decision making grid** efs.tki.org.nz/Curriculum-resources-and-tools/Decision-Making-Grids
	6. Use information to plan for action	• Decide on one action and plan in a group or individually how to implement the action. Use an action planning template if it helps. • Establish partners for support in actions. • Students are supported to develop a definite timeline and establish roles and deadlines for actions. **Managing self**	• To create a vision for a sustainable future in their community, waterways and harbour taking into account their own and others' attitudes and values. • Take action to work towards their vision.	**Action planning templates** efs.tki.org.nz/Curriculum-resources-and-tools/Action-Planner **SMART action planners**
	7. Time to plan and take action (could take several weeks and/or holidays) **Collect evidence and write up assessment**	• Time to carry out actions – visiting site, ringing partners, finding resources, organising dates, participating in projects, reflecting on plans. • Document plan, evidence of action and evaluations.	• Work with other people for a sustainable future and reflect on collaboration. • Experience how to plan an action using SMART. • Implement their own action. Critically evaluate their action in regard to a sustainable future.	**EfS 2.1 assessment task** Available at: aucklandcouncil.govt.nz

Learning intention	We are learning to use information to take meaningful action to reduce the impact of stormwater in our local environment.			Associated Achievement Standards
Possible assessments	**EfS 2.2 Achievement Standard: 90811** **Explain how human activity in a biophysical environment has consequences for a sustainable future.** **Credits: 4 Internal** Visit: nzqa.govt.nz/ncea/assessment/view-detailed.do?standardNumber=90811			**EfS 2.4** **Biology 2.1, 2.6** **Chemistry 2.1**
Key concepts	**Lesson outline**	**Possible learning experiences**	**Opportunities for students**	**Resources** Activities in **BOLD** are included in this resource
Scientific monitoring Ecosystems Urbanisation Biodiversity Sustainability Interdependence Community Ecosystem Whanaungatanga	**1. Introduce stormwater and mapping on GIS**	• What is stormwater? Discuss the consequences of urbanisation as a human activity on stormwater in the local catchment. Take photos of nearby stormwater drains and outlets to streams – find the worst and submit to Sustainable Coastlines: sustainablecoastlines.org • Use maps to identify a local stream and catchment. Identify land use that may impact on the waterway. • Use GIS to identify stormwater outlets and look at change in land use over time. Describe human intervention with stormwater in an urban environment. **Using language symbols and texts**	• Share prior knowledge about stormwater. • Use maps and GIS to gain understanding of catchment, streams and land use. • Explore the relationship between people, stormwater and streams. • To use new terminology: catchment, stormwater, ecosystem, habitat, impermeable surfaces, permeable surfaces.	**Stormwater mind map** American video youtube.com/watch?v=GrBEEjijxaY&feature=end-screen&NR=1 Sustainable Coastlines loveyourcoast.org/learn/ GIS environmental monitoring aucklandcouncil.govt.nz/EN/ratesbuildingproperty/propertyinformation/GIS_maps/Pages/Home.aspx **Surface types and their effect on the environment**
	2. Visit to the stream and link to stormwater	• Describe the physical environment of the stream, stormwater and why it affects humans and the environment. Draw a map of the stream and label abiotic and biotic features. Annotate and mark stormwater outlets. Draw cross sections of the stream.	• Connect with place and visit their local community. • Experience an environment outside the classroom. • Explain how the urban stormwater system impacts on the stream habitat of the catchment. • Describe how the urban stormwater system picks up pollution which affects the culture of the local community.	Take photos of significant findings – collate photos. **Support material (AS 90811 Student field trip worksheet 1)**

Key concepts	Lesson outline	Possible learning experiences	Opportunities for students	Resources Activities in **BOLD** are included in this resource
Scientific monitoring Ecosystems Urbanisation Biodiversity Sustainability Interdependence Community Ecosystem Whanaungatanga	**3. Water testing – Wai Care (biological and physical data)**	• Join Wai Care and collect data at the stream: - temperature, clarity, flow - pH, nitrates, phosphate, oxygen - macro-invertebrates - raise a fish trap. **Managing self**	• Collect robust scientific data from authentic site. • Compare data from GIS website.	**Support material (AS 90811 Student field trip worksheet 2)** Data from websites – Wai Care waicare.org.nz Tools- Environmental Monitoring in maps.aucklandcouncil.govt.nz/aucklandcouncilviewer/
	4. The stream ecosystem	• Investigate species at different sites. • Develop understanding of species tolerance to indicate the health of the stream. • Link change in habitats to stormwater. • Watch DVDs. • Research form and function of macroinvertebrates/fish/algae. • Create a wetland/stream food web and compare to species that are found in your stream.	• Interpret scientific data and connect cause and effect for changes related to stormwater. • Identify impacts on the ecosystem caused by loss of habitat – diversity, abundance, exotic species. • Use species names of organisms in ecosystems to understand interrelationships.	Macroinvertebrate identity sheets **Stream/wetland food web experiential activity and food web cards** **DVDs (free to Auckland schools):** *'The Guardians of the Mauri' and 'Nga Kaitiaki o te Mauri'* *'Focus on Bugs'* DVDs available by emailing: efs.administration@aucklandcouncil.govt.nz
	5. Interpreting stream data and stormwater	• Investigate the reasons for changes in stream habitat and project future issues. • Look at data over time for your site, compare with data from other sites from Auckland Council report cards and GIS environmental monitoring. **Thinking**	• Use scientific data to make conclusions and comparisons. • Understand the importance of science for measuring and providing information.	Student data Stream report cards stateofauckland.aucklandcouncil.govt.nz/report-type/freshwater-report-card/
	6. Exploring sustainability	• Explore the meaning of sustainability. Use the sustainability jigsaw to discuss aspects and interrelationships. Discuss how this environment could be sustainable now and in the future. Identify gaps in knowledge for research. • Compare Tāmaki river case study and Māori perspective.	• Use tools to illustrate aspects of sustainability and how they connect.	**Sustainability jigsaw activity** efs.tki.org.nz/Curriculum-resources-and-tools/Sustainability-Jigsaw **Aspects grid activity** efs.tki.org.nz/Curriculum-resources-and-tools/Aspects-of-Sustainability-a-graphic-organiser **Tāmaki river case study/questions**

Key concepts	Lesson outline	Possible learning experiences	Opportunities for students	Resources Activities in **BOLD** are included in this resource
Scientific monitoring Ecosystems Urbanisation Biodiversity Sustainability Interdependence Community Ecosystem Whanaungatanga	**7. Guest speakers**	• Invite guest speakers: - local iwi - Sustainable Coastlines to introduce the links between stormwater and the sea - stormwater engineer - freshwater scientist - community group - local industry. **Relating to others**	• Inquire into Māori perspectives of the local environment. • To ask questions of experts from different perspectives and explore alternative cultural perspectives.	Auckland Council Local residents and whanau Community experts
	8. Actions to improve stormwater impacts	• Use posters, maps, powerpoint and websites to explore consequences of increased population, impermeable surfaces, land use and behaviour on stormwater and relate this to a sustainable future. • Explain how urban planners have changed their perceptions of stormwater and streams and research stormwater management in relation to aspects of sustainability (environmental, social, economic, cultural).	• Imagine the future and realise the changes that will occur with increased populations and other pressures. • Realise that science informs decisions for the environment and humans.	**Stormwater powerpoint** aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/home.aspx **Stormwater poster** Available by emailing: efs.administration@aucklandcouncil.govt.nz
	9. Visit stormwater management developments	• Bus tour of local mitigation measures – constructed wetland, swales, permeable pavers, rain gardens and unsustainable practices. **Participating and contributing**	• Explore what professionals in different careers are doing to provide the best options for stormwater.	aucklandcouncil.govt.nz
	10. Present findings to appropriate audience	• Write a report for Auckland Council or your local board, create a documentary or scientific video to show the community.		**EfS 2.2 task** Available at: aucklandcouncil.govt.nz

Learning intention	We are learning to use information to take meaningful action to reduce the impact of stormwater in our local environment.			Associated Achievement Standards
Possible assessments	**EfS 2.3 Achievement Standard 90813** **Demonstrate understanding of how different values have implications for a sustainable future.** **Credits: 3 Internal** Visit: nzqa.govt.nz/ncea/assessment/view-detailed.do?standardNumber=90813			**EfS 2.1, 2.2** **Biology 2.1, 2.6** **Chemistry 2.1** **Geography 2.2, 2.6** **Social Studies 2.2**
Key concepts	**Lesson outline**	**Possible learning experiences**	**Opportunities for students**	**Resources** Activities in **BOLD** are included in this resource
Values Economics Ecological sustainability Culture Society Environment Respect Kaitiakitanga Interdependence Equity Diversity	**1. What are values?**	• Explore what values are and give examples. • Investigate different value positions in different scenarios. • Discuss student values.	• Develop understanding of values, their own and others. Link values to sustainability.	**NZC page 10 – values** **Tāmaki River case study**
	2 Establish prior knowledge about stormwater	• Mind map, KWHL table, cooperative grid.	• Share their knowledge about stormwater.	**Stormwater mind map** efs.tki.org.nz/Curriculum-resources-and-tools/The-Cooperative-Learning-Grid **DVDs (free to Auckland schools):** *'The Guardians of the Mauri' and 'Nga Kaitiaki o te Mauri'* *'Focus on Bugs'* DVDs available by emailing: efs.administration@aucklandcouncil.govt.nz
	3. Visit your community and local waterway	• Visit a local stream and include experiential activities to connect students with the place. E.g. sound log, capturing photos and reflection. Using pictures or words to describe the place.	• Discuss values in their local community and environment.	**Sound log – record sounds.** Magic spot – students reflect in silence and record with a picture/word or symbols. Human camera and reflective statements: "I see, I feel, I think..." Frame camera around things that students value.
	4. Investigate local stream and stormwater impacts	• Use GIS to identify the catchment, the stream from source to sea, the changes in land use and impact of stormwater. How has the area changed over time and what is valued?	• Use GIS viewer and the different overlays and functions to identify terrain, waterways, stormwater infrastructure and changes over time.	GIS environmental monitoring aucklandcouncil.govt.nz/EN/ratesbuildingproperty/propertyinformation/GIS_maps/Pages/Home.aspx **Surface types and their effect on the environment**

Learning intention	We are learning to use information to take meaningful action to reduce the impact of stormwater in our local environment.			Associated Achievement Standards
Possible assessments	**EfS 2.3 Achievement Standard 90813** **Demonstrate understanding of how different personal values have implications for a sustainable future.** **Credits: 3 Internal** Visit: nzqa.govt.nz/ncea/assessment/view-detailed.do?standardNumber=90813			**EfS 2.1, 2.2** **Biology 2.1, 2.6** **Chemistry 2.1** **Geography 2.2, 2.6** **Social Studies 2.2**
Key concepts	**Lesson outline**	**Possible learning experiences**	**Opportunities for students**	**Resources** Activities in **BOLD** are included in this resource
Values Economics Ecological sustainability Culture Society Environment Respect Kaitiakitanga Interdependence Equity Diversity	**5. Aspects of sustainability**	• Use a sustainability model to make connections between the environment, society, culture and economics.	• Compare a strong sustainability model and discuss aspects of sustainability in relation to stormwater.	**Aspects of sustainability activity** **Stormwater posters –** alternative stormwater options. Posters available by emailing: efs.administration@aucklandcouncil.govt.nz
	6. Guest speakers	• invite speakers to class • freshwater scientist • stormwater engineer • local kaumatua • community groups • Wai Care • urban developer.	• Identify people who could share different values and perspectives about waterways and how that affects decisions and action.	For example; Freshwater scientist Property developer Council officer Local Iwi Landowner
	7. Consequence wheel	• Use the consequence wheel to explore a range of values positions.	• Relate values to possible outcomes.	**Consequence wheel template** efs.tki.org.nz/Curriculum-resources-and-tools/Consequence-Wheel
	8. Assessment	• What's up in my stream?		**EfS 2.4 task** Available at: aucklandcouncil.govt.nz

CURRICULUM LEVEL 8

Education for Sustainability

Auckland Council has generated this level 8 stormwater task in recognition of the critical role organisations play in stormwater outcomes. We really encourage you to take the lead in offering this task to your students. Where students do not have access to an organisation, the council can assist with finding an organisation for your students to work alongside.

- Evaluate social, economic, and technological measures that could be taken to sustain natural resources and improve biodiversity now and for the future.
- Analyse the impact of strategies and initiatives for a sustainable future.
- Analyse actions necessary for sustainability and plan, implement and critically evaluate a personal action for a sustainable future.

Science

Nature of Science (NOS): Communicating in science, participating and contributing.

- **Planet earth and beyond:** Develop an in-depth understanding of the interrelationships between human activities and the hydrosphere and biosphere over time.
- **Geography:** Understand how people's diverse values and perceptions influence the environmental, social and economic decisions and responses they make.

Learning intention	We are learning to use information to take meaningful action to reduce the impact of stormwater in our local environment.			Associated Achievement Standards
Possible assessments	**EfS 3.5 Achievement Standard: 90832** **Develop a strategy for an organisation that will contribute to a sustainable future.** **Credits: 5 Internal** **Visit:** nzqa.govt.nz/ncea/assessment/view-detailed.do?standardNumber=90832			**Geography 3.6** **Chemistry 3.1** **Technology 3.1, 3.2, 3.31**
Key concepts	**Lesson outline**	**Possible learning experiences**	**Opportunities for students**	**Resources** Activities in **BOLD** are included in this resource
Resilience Respect for all life Social justice Finite resources Intergenerational equity	**1. Research stormwater issues in relation to sustainability**	• Review your understanding of sustainability using new examples, case studies and activities to relate to stormwater. • Compare a range of strategies and identify essential elements of strategy and what they mean (see assessment resource for examples).	• Make connections with all aspects of sustainability and stormwater. • Gather an understanding of relevant contemporary ideas on stormwater to inform decisions.	**Support materials (AS 90832 Student activity. HGMP decision matrix for action and worksheets).** aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/home.aspx efs.tki.org.nz/Curriculum-resources-and-tools/Sustainable-Options Strategy mfe.govt.nz/publications/urban/urban-toolkit-2009/html/page7.html
	2. Visit relevant stormwater sites in your community	• Visit stormwater outlets, streams and estuaries. Investigate the stormwater system on GIS.	• Experience the environment where change could enhance the community.	**Surface types and their effect on the environment**
	3. Identify organisations for partnerships and set up collaborative planning	• Research possible stormwater issues and current ideas for reducing impacts. • Model cooperative learning strategies and communication techniques.	• Collaborate with outside partners to connect learning to authentic situations.	Where students do not have access to an organisation, the council can assist with finding an organisation for your students to work alongside. Contact: efs.administration@aucklandcouncilgovt.nz
	4. Research the organisation's impact on stormwater	• Visit an organisation and discuss common goals for stormwater outcomes. • Carry out a needs analysis to identify gaps and strengths.	• Experience working with other members of the community.	PCE Fresh Water Quality in New Zealand pce.parliament.nz/assets/Uploads/PCE-Water-Quality-in-New-Zealand.pdf Hauraki Gulf Forum Report

Key concepts	Lesson outline	Possible learning experiences	Opportunities for students	Resources Activities in **BOLD** are included in this resource
Resilience Respect for all life Social justice Finite resources Intergenerational equity	**5. Explore aspects of sustainability in relation to the organisation's practices**	• Collaboratively decide on actions for a strategic plan.	• Reflect on potential of working with organisations to take action.	**Support materials (AS 90832 Student activity. Decision matrix).**
	6. Investigate strategies and how to develop/purpose	• Research possible outcomes and set targets/indicators to inform progress. • Develop criteria for effective stormwater planning to use in an evaluation.	• Develop understanding of strategies in order to support their ideas of planning.	unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/ **Support materials (AS 90832 decision matrix)**
	7. Create visions for a sustainable future for local community	• Use role playing to envisage the future and how the local community and environment could be affected.	• Imagine possible futures using new information and relate to a strategy that will create a better future.	**Support materials (AS 90832 social marketing strategy)**
	8. Develop your strategy for presentation	• Develop strategy and present.		
	9. Assessment			**Assessment task 3.5** Available at: aucklandcouncil.govt.nz

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

INTERNAL ASSESSMENT RESOURCE: EFS 2.1 (2015)

Education for Sustainability (EfS) Level 2

Supports internal assessment for Achievement Standard: 90810

Credits: 6

Storming the Waters! Stormwater Action
Undertake a personal action, with reflection, that contributes to a sustainable future.

This resource has been generated by Auckland Council with Auckland schools. Assessment resources are still to be moderated. It is provided for educational purposes only for the aligned Education for Sustainability Achievement Standards. It is based on the learning objectives from seniorsecondary.tki.org.nz/Social-sciences/Education-for-sustainability

Teachers must manage authenticity for any assessment from a public source, because students may have access to assessment schedule or student exemplar material. Using this assessment resource without modification may mean that students 'work is not authentic.

TEACHER GUIDELINES

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Context/setting

Students will need the opportunity to learn about:

- sustainability issues with regards to stormwater
- action planning
- taking action and documentation
- evaluation and reflective process.

The action project the students choose should be manageable within the time frame set. They can work in a group and with an outside organisation or individuals in order to develop insight and gather evidence into their chosen issue for action as well as working cooperatively to carry out the action. This could be within the school or local community. Each student must **present an individual plan and evaluation** as well as evidence of their part in the implementation of the action.

The aspects of sustainability and their interdependence will have been addressed in the learning program. Maori concepts and values relating to the environment included wherever possible.

Issues of sustainability with regards to stormwater, e.g. contamination to waterways, impermeable surfaces, sedimentation, heavy metals, road runoff, polluted waterways, community health, outlets into harbour and estuaries, loss of biodiversity, cultural significance of waterways, flooding and growth of urban areas.

Students will learn about stormwater planning and management and options in the Auckland setting. Students will be familiar with:


The 'Auckland Council stormwater information': aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/home.aspx


waitakere.govt.nz/AbtCit/ei/EcoWtr/index.asp


Wai Care action planning: WaiCare.org.nz/Home.aspx

Students need to be familiar with the action-oriented process of the *Guidelines for Environmental Education in New Zealand Schools* (pg 74), Learning Media, Ministry of Education, 1999, and the relevant concepts and terms relating to a range of Level 7 Achievement Objectives as outlined in *The New Zealand Curriculum*, Learning Media, Ministry of Education, 2007, and supporting curriculum documents. See:


seniorsecondary.tki.org.nz/Social-sciences/Education-for-sustainability/Learning-objectives


efs.tki.org.nz

The learning progamme will incorporate learning experiences where students will have the opportunity for experiential learning **in** the environment, (e.g. stream or stormwater remediation or stream testing), **about** the environment, (issues and strategies relating to stormwater), and **for** the environment, (action for improving stormwater e.g. riparian planting, community awareness-raising, or the adoption of public transport).

Students are encouraged to carry out their action in their school or local community to enable the setting of realistic objectives and timeframes. It is important that students choose their own action around reducing stormwater impacts so there is a sense of meaning and purpose.

Cleaning up litter from streams is not considered an action for sustainability unless the cause of the issue is also addressed or there is another purpose like community engagement. For example, students could investigate sources of the litter and choose to target that in the action. However, a stream clean-up may be used as an introductory learning experience to provide students with data about the type of litter and also develop an emotional response to the issue which could motivate action and to get more people involved. Sustainable Coastlines carries out beach cleanups and have a project linking to stormwater drains.

sustainablecoastlines.org/

Documentation

This can take any format agreed by students and/or teachers, e.g. the plan and evaluations could be a report, presentation or video and can include photos, speeches, websites, letters, and/or blogs as evidence of action. The student must present individual evidence of planning and evaluation but can share evidence of action.

Evaluation and reflective process

Reflective practices need to be taught and students must keep a learning journal or blog in which to record thoughts and ideas about the action process.

Conditions

It is expected that students will complete this action assignment over an extended period of time (say 10 -16 weeks) in order to complete their actions. Consultation is necessary and may be done through milestone meetings where students will discuss appropriateness of their action and time management.

In order to ensure authenticity of student work, individual reflective logs or learning journals are to be kept along with evidence of the processes involved while planning and taking action. The students may plan and carry out the action in groups however the report of their plan, action, and evaluation that is submitted must be completed individually.

The planning of the action may be completed in class time but aspects of the action will need to be done in the student's own time. The action plan and evidence of the implementation needs to be sighted by the teacher at scheduled times.

Resource requirements

Students should have been introduced to the concept of action and have explored examples of action for sustainability. It could be useful here to invite a speaker from a well-known organisation, e.g. Auckland Council or Wai Care, which has taken action for sustainability, so that students can hear the philosophy behind the action and develop an understanding of the skills required.

It is expected that students will have an understanding of the concept of a sustainable future. It is important that time is allocated so that students can investigate the criteria other organisations use to judge whether the actions they are taking meet sustainability outcomes. Relevant organisations include councils, community groups and businesses. Students also need to develop criteria by which they can evaluate the effectiveness of their personal action plan towards a sustainable future. This includes the identification of key competencies and project management skills they are developing while working collaboratively to develop a plan.

decision-making-confidence.com/decision-making-process-grid.html

Name: _____

INTERNAL ASSESSMENT RESOURCE

Achievement Standard Education for Sustainability 90810: Undertake a personal action,with reflection, that contributes to a sustainable future.

Subject reference: Education for Sustainability 2.1
Resource title: Storming the Waters! Stormwater action.

Credits: 6

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
Undertake a personal action, with reflection, that contributes to a sustainable future.	Undertake a personal action, with in-depth reflection, that contributes to a sustainable future.	Undertake a personal action, with critical reflection, that contributes to a sustainable future.

STUDENT INSTRUCTION SHEET

By the end of this assessment activity you will submit evidence to show that you can:

- plan an action for stormwater that will contribute towards a sustainable future
- implement the plan of action
- critically evaluate the effectiveness of the action in relation to sustainability
- identify a personal response to the action.

Aim: this can be a group action project but the report submitted must be individual.
Time: in order to complete this assignment you will be allocated in-class time but you will be expected to complete much of it during homework time and in the holidays.

Due: ____/____/____

Late submissions will not be accepted without the permission of the school's Assessment Co-ordinator.
You are required to complete a learning journal of the investigation you have done for the development and implementation of your action plan. Your journal may be in the form of a wiki, blog or notebook. You will be given dates when it is expected you will conference with your teacher to discuss progress and the relationships you have established with the people or organisation(s) involved with the action which you have chosen.

Dates for conferencing:

Name: _____

Task 1: Understanding the issue

a) Describe stormwater and the issues that it causes in your community.
Describe your catchment and identify if it is urban or rural.

b) Explain why stormwater is a sustainability issue that affects Auckland's communities and harbours.
Identify how stormwater affects the environment, people and/or the economy of your community.

c) Gather and use data such as stream monitoring, water testing, observations, photos of stormwater drains and GIS data. intermaps.arc.govt/AucklandCouncilViewer/ to inform your action group about stormwater in your community.

d) Identify individuals or organisations that are involved with stormwater in your community.
Can you identify human activities on land that pollute stormwater? An example would be a business that washes their cars on the street or in their parking lot with detergent or other car washing chemicals.

e) In a small group, brainstorm a range of solutions to improve stormwater and reduce stream and harbour contamination. What is the source of pollution? How can we prevent or reduce it? Research actions other groups have taken in New Zealand and globally to improve stormwater.
aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/home.aspx

f) Use the information you have collected to help develop an action plan that is
SMART
S = specific
M = measurable
A = achievable
R = relevant
T = time appropriate.

g) Create a vision of what you hope will happen in one year, five years or twenty years (be positive) and describe how your action will contribute towards a better future.

Name: _____

Task 2: Planning

a) Individually develop a detailed plan. Your plan will include:

- a clear goal or purpose that you can measure and a description of how the goal will contribute to your vision of a sustainable future
- a sequence of steps to carry out with a time line. Use the '5W's' to help. (What? Who? When? Where? Why? How?)
- an outline of the roles others may take in supporting you to undertake the action
- criteria that will evaluate the effectiveness of your action for a sustainable future. How will you know if your action has been successful?

Note: At this stage it is important that you take the time to investigate the criteria other organisations use to judge whether the actions they are taking meet sustainability outcomes.
Once you have some examples of these criteria draw up your own that you will use to evaluate the effectiveness of your action.

Milestone 1. Your action plan needs to be approved by your teacher before it is implemented.
(Teacher to insert date:) ____/____/____

Task 3: Implementing your action

a) Keep a record of the dates and the activities you and your group were involved in. This is to be written up in the learning journal or log and can be supplemented by photos, newspaper articles, video clips, etc. that illustrate your action(s).

b) Reflect on your plan and describe any barriers that you faced. Include any modifications to your action plan and give the reasons why any changes were made.

Remember to keep a learning journal of your action process – enter your reflections daily.
Questions you may ask yourself are:
What did I do this week?
How did I feel about my progress?
What have I learned? Which people did I meet with?
What do I plan to do next?

Milestone 2. Your teacher or project mentor will sign your learning journal at regular intervals.
Dates will be given to you to show evidence of implementation.

Name: _____

Task 4: Evaluation

How effective has your action been in achieving your goal?
(It doesn't matter if it has been unsuccessful as long as you can explain why and suggest improvements).

a) Use data or evidence you have collected to evaluate your success on reducing the impacts of stormwater in your community.

b) Use your criteria (from task 2) to critically evaluate your action in achieving your goal.
Identify and discuss the strengths, weaknesses, opportunities and threats of your action based on your criteria.

c) Has taking action affected your own attitudes or behaviours in relation to stormwater?
If so, explain how. If there has been no change, explain why.

d) Using all the answers in task 4, discuss the ways that your action contributes to a sustainable future.
Include consequences to the environment and to the economy as well as to people and cultures.
You may apply Māori concepts and include recommendations for future actions.

(Teacher to select presentation format – could be a PowerPoint, written report, video or a speech with the learning journal as evidence).

Name: _____

Checklist

Your report should include:

Action chosen and the reason relating to a sustainable future	Complete
• Clear goal relating to an outcome to improve stormwater. Description of the stormwater issue.	
• The environmental, social, economic and/or cultural aspects of the issue and the action.	
• Vision of the future, if action is successful.	

A detailed plan with evidence of action

• Steps needed to carry out action.	
• A timeframe of when they need to be completed.	
• Roles - Identifying who will do each task.	
• Who will help and what information do you need?	
• Photos, data and results of your action.	

Critical evaluation of how the action supports sustainability

• Explain what has happened as a result of your action.	
• Has it changed the environment or people's behaviour?	
• Will it impact on your community or the economy?	
• Is your action sustainable now and in the future?	

Personal reflection of your attitudes, values and behaviours in response to carrying out this action

• How did you feel taking action?	
• What did you learn?	
• Has it changed your own attitudes about stormwater, your environment or your community?	
• Has it changed your attitude about what you can achieve?	

Assessment Schedule: EfS 2.1 Storming the waters! stormwater action

Task	Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
	Undertake a personal action, with reflection, that contributes to a sustainable future	Undertake a personal action, with in-depth reflection, that contributes to a sustainable future	Undertake a personal action, with critical reflection, that contributes to a sustainable future
Task 1	**Understanding the issue** • Outline of importance of the stormwater issue with at least one aspect of sustainability.	As for achieved.	As for achieved.
Task 2	**Planning** • Goal stated. • One action recommended. • Contribution of action to aspect(s) of sustainability identified and linked to stormwater issue. • Description of clear steps to be taken. • Time frame shows a clear sequence. • Data collection and /or measurement methods stated.	As for achieved.	As for achieved.
Task 3	**Evidence of action implemented**		

Task 4	**Evaluation**
	Written evaluation and learning journal providing evidence submitted, including any modifications to the original plan.
	• Judgment of the effectiveness of the action plan provided.
	• How action contributed to a sustainable future based on the aspect(s) of sustainability addressed in the plan
	• Evidence of appropriate data collection and validity of measurements.
	• Personal response to the action is described and related to whether it had changed their attitudes, values or behaviours, with regards to their responsibility towards resource use and waste (no change is acceptable with reasonable discussion).
		Comprehensive evaluation
		As for achieved, plus:
		• A personal response explains why or why not the personal action changed own attitudes, values or behaviours in relation to the sustainability issue.
			Critical evaluation
			As for achieved, plus:
			• Drawing conclusions of the strengths, weaknesses, opportunities and threats of the action in relation to aspect(s) of sustainability
			• The effectiveness of the action is evaluated on criteria based on aspects of sustainability in contributing to a sustainable future.
			• A personal response to the action provided using supporting evidence and examples using one or more of;
			  • Stating supported opinions or judgments
			  • Considering implications
			  • Projecting future impacts
			  • Evaluating options
			  • Suggesting alternatives and next actions for personal and social responsibility
			  • A discussion as to whether the action has changed their attitudes, values or behaviours in contributing to a sustainable future (no change is acceptable with reasonable discussion).

Please refer to assessment schedules for internal assessment resources for examples of student responses.

ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards/Social-sciences/Education-for-sustainability/Level-2-Education-for-sustainability

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

INTERNAL ASSESSMENT RESOURCE: EFS 2.2 (2015)

Education for Sustainability (EfS) 2.2

Supports internal assessment for Achievement Standard: 90811

Credits: 4

Stormy Waters – The science of stormwater
Explain how human activity in a biophysical environment has consequences for a sustainable future.

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Teachers must manage authenticity for any assessment from a public source, because students may have access to assessment schedule. Using this assessment resource without modification may mean that students' work is not authentic.

TEACHER GUIDELINES

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Education for Sustainability 90811. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

Students will need the opportunity to learn about:

- stormwater
- data collection of the impact stormwater has on a stream environment
- human activity and stormwater
- sustainability of a biophysical environment
- consequences for a sustainable future including environmental, social, economic and/or cultural aspects around stormwater.

This assessment activity requires students to conduct an inquiry into human activity in relation to stormwaterthat affects a local stream and to present evidence on the consequences of this activity on a sustainable future.

Adapt the activity to meet the needs and interests of your students. Select a stream environment in your local community. Students could use their own field data and observations collected during their practical investigation work as well as relevant resources and information they collect during their research. You can also provide resource materials (including tables, graphs, resources sheets, photographs, websites, videos and/or reference texts) as appropriate.

Teachers can adapt the task (and assessment schedule) to suit an investigation of a local environment, e.g. a wetland, stream, river, lake or estuary. Students may use a range of data, collected by themselves and others, or provided by the teacher, in order to investigate the consequences of human activity on the ecology and one other physical system. Information about at least two interrelated species should be included in their final report.

This assessment task has been written to work in conjunction with the internal assessment resource for EfS 2.1.

Conditions:

It is expected that students will complete this assessment activity over an extended period of time between 6-8 weeks. Meet with students on a regular basis to monitor progress.

The total time for the assessment will depend on whether it is completed in conjunction with the final written report for EfS 90810 Undertake a personal action, with reflection that contributes to a sustainable future or otherwise. Wherever such integration between different parts of the programme occurs, teachers must ensure that opportunity for the work presented for each assessment is developed sufficiently in order to meet the criteria for each standard. In all such cases, teachers should refer closely to each relevant standard, including the explanatory notes and the conditions of assessment.

Resource requirements

Students should have access to;

- a local stream environment for data gathering
- technology and relevant equipment for data collection
- internet and useful websites relating to stormwater.

Additional information

This assessment resource requires the student to conduct an inquiry into human activity related to stormwater and the impact on a sustainable future. Students will need to develop understanding about the aspects of sustainability – environmental, social, economic, and cultural, and/or Māori concepts related to streams and waterways. The expression of Māori concepts will vary between hapū and iwi. Consult with your local Māori community on how these concepts should be expressed.

This assessment will benefit from working with Wai Care waicare.org.nz, which is a community stream monitoring initiative. Students will require internet access for research.

The Education for Sustainability community on TKI provides useful material to support this activity. efs.tki.org.nz

Ministry for the Environment reports provide a variety of examples of human interations that affect waterways. mfe.govt.nz/publications/water/

Biodiversity NZ biodiversity.govt.nz/resources/index.html

Department of Conservation (DOC) doc.govt.nz/nature/valuing-nature/biodiversity

Auckland Council information about stormwater and relevant catchments:

aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/home.aspx

aucklandcouncil.govt.nz/en/ratesbuildingproperty/propertyinformation/gis_maps/pages/home.aspx

Name: _____

INTERNAL ASSESSMENT RESOURCE

Achievement Standard Education for Sustainability 90811: Explain how human activity in a biophysical environment has consequences for a sustainable future.

Subject reference: Education for Sustainability 2.2
Resource title: Stormy Waters – The science of stormwater

Credits: 4

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
Explain how human activity in a biophysical environment has consequences for a sustainable future.	Explain in-depth how human activity in a biophysical environment has consequences for a sustainable future.	Comprehensively explain how human activity in a biophysical environment has consequences for a sustainable future.

STUDENT ASSESSMENT CONDITIONS

Human impact on our local stream

- This assessment will involve a field trip to a local stream to gather evidence.
- You will be assessed on how well you discuss the consequences of human activity, related to stormwater, on your local stream environment.
- You will complete the assessment task under test conditions on (insert date) _____.
  You will have approximately 10 hours of class time to complete this assessment using the evidence you have collected.
- No assessment materials must leave the classroom. At the end of each period you must hand in your assessment and related materials to your teacher.
- If you need extra paper ask your teacher for more.

Dates of the assessment: _____

Authenticity statement: Please read the following authenticity statement and sign below.

The work I hand in for assessment purposes will be my own. I will not give my work to another student who may present it as their own.

I understand that if I am found to have submitted work that is not my own, or given my work to another student, I will receive no credits for that assessment.

I have read and fully understand the above statement and this assessment task is my own work.

Student signature: _____

Name: _____

STUDENT INSTRUCTION SHEET

For this assessment you are expected to visit a local stream environment _____ and gather evidence to discuss the consequences that human activity has on stormwater and how it affects the future sustainability of the stream, the harbour and the people who live there.

You will use material from class and your own field work. Use a learning journal or log book to document your research and reflections. You may include video, photos, interviews etc.

By the end of the assessment activity you will submit evidence to show that you have collected scientific data to determine the consequences of stormwater on a local stream and the consequences for a sustainable future.

In urban areas, stormwater flowing off surfaces such as roads, pavements and roofs can contain elevated levels of a range of pollutants including vehicle fuel and oil, heavy metals, rubbish, fertilisers, pesticides and fine sediment. It can also be much warmer than the rain if it has run over warm roads and other impervious surfaces, which will reduce the amount of dissolved oxygen in the water. This stormwater can cause harmful effects when it enters the streams and rivers flowing through an urban area.

Name: _____

Task 1: Explain key features of the stream environment.

You can complete this work individually or as part of a group and you may discuss your ideas and questions with other stakeholders, including your teacher.

On the map provided, show the location of the stream in your community that you are investigating which receives stormwater runoff. Indicate any key features or land use that will contribute to stormwater runoff. You may use GIS at: aucklandcouncil.govt.nz/EN/ratesbuildingproperty/propertyinformation/GIS_maps/Pages/Home.aspx and include the different map views to help you. You may wish to outline the catchment of the stream you are studying and the beginning and end of the stream.

Draw a diagram of the stream area you will be collecting data from. Identify the biotic (living) and abiotic (non-living) factors. Use your observations to describe how stormwater might affect this local stream environment.

(Teachers you will need to cut and paste a map into the space below to show the location of your stream environment for this activity)

Name: _____

Space provided for any additional images needed.

Name: _____

Task 2: Explain the biophysical nature of the stream environment. Include any data you have measured

A) Ecological system

Draw the main food web of the stream in your local catchment. Be sure to identify species names, direction of energy flow, and whether each organism is a producer, consumer, or decomposer. Identify the species you have found in your investigation and explain how they provide information on the quality of the environment.

Drawing:

Name: _____

B) Hydrological system

Investigate the water quality of the stream. Use information and data that you have gathered that may include flow, clarity, nitrogen, phosphate, oxygen levels, pH, temperature, heavy metal concentrations and substrate to describe the stream environment.

Explain how water quality interacts with the ecological system.

Name: _____

Task 3: How does human activity in your area affect stormwater and what are the consequences on the local stream.

Outline human activity that impacts on stormwater in your community. You can include pictures and descriptions. You may include positive and negative examples of human activity on stormwater. Include why it happens, when it happens, and where it happens?

Activities may include drains, pipes, urban development, building impervious surfaces, riparian planting, culverts, day-lighting, raingardens.

Name: _____

Task 4: Explain how human activity impacts stormwater and the consequences for the sustainable future of Auckland.

Using the information from tasks 1-3, discuss a range of consequences human activity has on stormwater and the biophysical environment. Include how stormwater has impacted the biology of the environment and the physical stream environment. Use additional refill if necessary.

Use evidence to explain three consequences of human activity on stormwater and your stream environment.	Draw conclusions about the consequences of human activity on the future sustainability of Auckland? (Consider impacts to environmental, economic, and/or socio-cultural sustainability).
1	
2	
3	

Name: _____

Consider the wider implications of these consequences for a sustainable future. This may include projections of future impacts.

Choose one of the consequences you identified above. Write it in the box below:

Use research to outline two possible future options and explain how it could improve the biophysical environment.

1	2

Discuss how these improvements could impact on the future of Auckland.

Assessment schedule: EfS 2.2 Stormy waters – the science of stormwater

Task	Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
	Explain how human activity in a biophysical environment has consequences for a sustainable future.	Explain in- depth how human activity in a biophysical environment has consequences for a sustainable future.	Comprehensively explain how human activity in a biophysical environment has consequences for a sustainable future.
1 2	• Explanation of the characteristics of the local stream in relation to stormwater. Could include a map showing key features. • The biophysical environment is an urban stream with a muddy or rocky bottom with a gentle flow rate. The stream is near the bottom of the catchment which is mainly housing with some industry further upstream. There is some riparian planting where we tested the stream but some of the stream is piped. • Ecological system and the physical system it interacts with is explained. This will include data and measurements. *Algae and plant species are key producers and provide the basis for a complex food web (illustrated) with a range of macro-invertebrates that are indicators for the health of the stream environment. The presence of several damselfly larvae and mites from invertebrate sampling indicate that the stream is not completely degraded but not fully healthy.*	As for achieved.	As for achieved.
3	An outline of human activity that impacts on stormwater and the local stream. *Stormwater comes off the road, which is an impermeable surface and is piped into the stream at various points. Urban development is a human activity that increases impermeable surfaces that increases stormwater runoff pollutants from cars can be collected by stormwater off roads which also enters the streams. The stormwater also collects sediment from the new building development which is not protected near to the stream.*	As for achieved.	As for achieved.

Task	Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
	Plan, implement and evaluate a personal action that will contribute towards a sustainable future.	Plan in detail, implement and comprehensively evaluate a personal action that will contribute towards a sustainable future.	Plan in detail, implement and critically evaluate a personal action that will contribute towards a sustainable future.
4	Conclusions of the consequences of human activity and stormwater are stated in relation to a sustainable future. *After heavy rain the stormwater brings mud and sand from the land. This makes the water less clear which makes it more difficult for kokopu to find food and also affects the gills of the macro-invertebrates for example, damsel fly larvae. This disrupts the food chain in the stream as some species do not survive and the health of the stream deteriorates and will continue to get worse .*	Informed conclusions about why human activity in a biophysical activity has consequences for a sustainable future in terms of aspects of sustainability. The clear logical conclusions will be supported by evidence. *As this stream is in the middle of an urban environment there is an increase of impermeable surfaces and runoff areas where the stormwater can collect pollutants and sediment. As the city grows more and more land is cleared to build new houses. When the land is cleared it is easy for rain to wash the surface soil on to the roads and into the stormwater drains and the streams. This means that the particles of mud make the water cloudy and the habitat for the macro-invertebrates less tolerable. Not as many macro-invertebrate species can survive so there is less food for fish and they could leave or eventually die out. Then the habitat would only have more tolerant species like bloodworms that can survive the conditions.*	Insightful conclusions are drawn about the wider implications of how human activity and stormwater in a biophysical environment has consequences for a sustainable future. The conclusions may include projections of future impacts and consideration of options that may improve the a sustainable future. *Sediment suspended in the water or settled on the streambed makes the habitat less suitable for organisms like mayfly larvae. As the stream becomes more degraded and other small organisms die out, species like native freshwater fish which are higher up the food chain are affected. There is less and less biodiversity as the stream becomes more degraded. This sediment will eventually travel down to estuaries, affecting migration of juvenile fish and silting up the harbours. Not only does this affect the physical habitat of the receiving harbour there is less food for marine species and therefore limits population. There are more regulations about containing sediment runoff that could prevent some silt but these need to be strictly enforced.*

The examples above relate to only part of what is required, and are purely indicative.

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.

Please refer to assessment schedules for internal assessment resources for examples of student responses.

ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards/Social-sciences/Education-for-sustainability/Level-2-Education-for-sustainability

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

INTERNAL ASSESSMENT RESOURCE: EFS 2.3 (2015)

Education for Sustainability (EfS) Level 2

Supports internal assessment for Achievement Standard: 90813

Credits: 3

What's up in my stream?
Demonstrate understanding of how different personal values have implications for a sustainable future.

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Teachers must manage authenticity for any assessment from a public source, because students may have access to assessment schedule or student exemplar material. Using this assessment resource without modification may mean that students' work is not authentic.

TEACHER GUIDELINES

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Education for Sustainability 90813. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

This standard requires an understanding of Learning objective 7.3: ***Students will gain knowledge, skills, and experience to: examine the values of different groups of people, how these values are expressed in various practices, and the present and future consequences for sustainability***.

Context/setting

Students will need the opportunity to learn about:

- personal values and related attitudes and behaviour
- a range of values associated with stormwater and the environment
- how different values impact on stormwater management
- implications for a sustainable future.

This assessment task does not require a value change by the students but it does encourage them to explore different value positions and understand the behaviours that arise from those values. They are also challenged to reflect on their own values and behaviours in relation to sustainability. It is not their values or behaviours that are being assessed here but their ability to discern (explain or discuss) which values and behaviours would support a sustainable future. They could visit a stream environment to explore the impact of stormwater and also have the opportunity to have guest speakers with a range of perspectives on stormwater the environment.

Conditions

The students may have access to their stormwater notes and other resources that will help them complete the tasks. This is not a closed book assessment but must be completed individually.

It is suggested that this activity take place over 3-5 weeks .

Resource Requirements

Students will require internet access for research.

Students will complete this assessment using the resources included in this resource and niwa.co.nz/freshwater-and-estuaries/stormwater-management/stormwater-an-introduction

Site and catchment maps can be generated on Auckland Council's GIS viewer. They can be set up as aerial maps, showing streams and the stormwater network. See: Aucklandcouncil.govt.nz/EN/ratesbuildingproperty/propertyinformation/GIS_maps/Pages/Home.aspx Contact Auckland Council's Call Centre for further support on 09 301 0101.

waitakere.govt.nz/abtcit/ei/ecowtr/stormwater/index.asp

Additional Information

This assessment resource requires the student to conduct an inquiry into different values related to stormwater and the environment and the implications for a sustainable future. Students will need to develop understanding about the aspects of sustainability – environmental, social, economic, and cultural, and/or Māori concepts related to stream and waterways. The expression of Māori concepts will vary between hapū and iwi. Consult with your local Māori community on how these concepts should be expressed.

This assessment will benefit from working with Wai Care waicare.org.nz, which is a community stream monitoring initiative and could be done in conjunction with achievement standard 90810 and/or 90811.

Name: _____

INTERNAL ASSESSMENT RESOURCE

Achievement Standard Education for Sustainability 90813:
Demonstrate understanding of how different personal values have implications for a sustainable future.

Subject reference: Education for Sustainability 2.3
Resource title: What's up in my stream?

Credits: 3

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of how different personal values have implications for a sustainable future.	Demonstrate in-depth understanding of how personal values have implications for a sustainable future.	Demonstrate comprehensive understanding of how personal values have implications for a sustainable future.

STUDENT INSTRUCTION SHEET

You must complete all tasks. Use the spaces provided in the booklet. Use the space provided as a guide to the amount you should write down. Your answers may include other resources you have gathered in class and at home and your own knowledge, ideas, and understanding of stormwater.

For this assessment you will:

- Demonstrate comprehensively your understanding of how different personal values associated with stormwater and the environment have implications for a sustainable future. Reflect on your own values and associated behaviour about stormwater and the environment and how these have implications for a sustainable future.
- This assessment is not about values positions and why people hold them but an exploration of the values and behaviours that support a sustainable future. In order to explore those positive values and behaviours it may be pertinent to explore the oppositional position i.e. values and behaviours that do/would not support a sustainable future.

Name: _____

A sustainable future requires the development of ways of thinking and acting to meet the needs of the present generation without compromising the ability of future generations (of all living things) to meet their own needs. In Aotearoa New Zealand, a sustainable future reflects, wherever possible, consideration of Māori concepts and values relating to the environment, which may vary between hapū and between iwi.

Values are deeply-held beliefs that influence the way people think, feel and act.

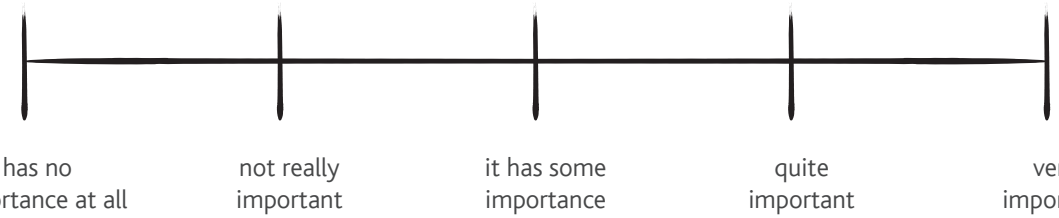
Behaviours in this context are actions in a given situation that arise from people's values.

Implications for a sustainable future are the potential result of behaviours that promote or disrupt the sustainability of an environment.

Identify your value of stormwater

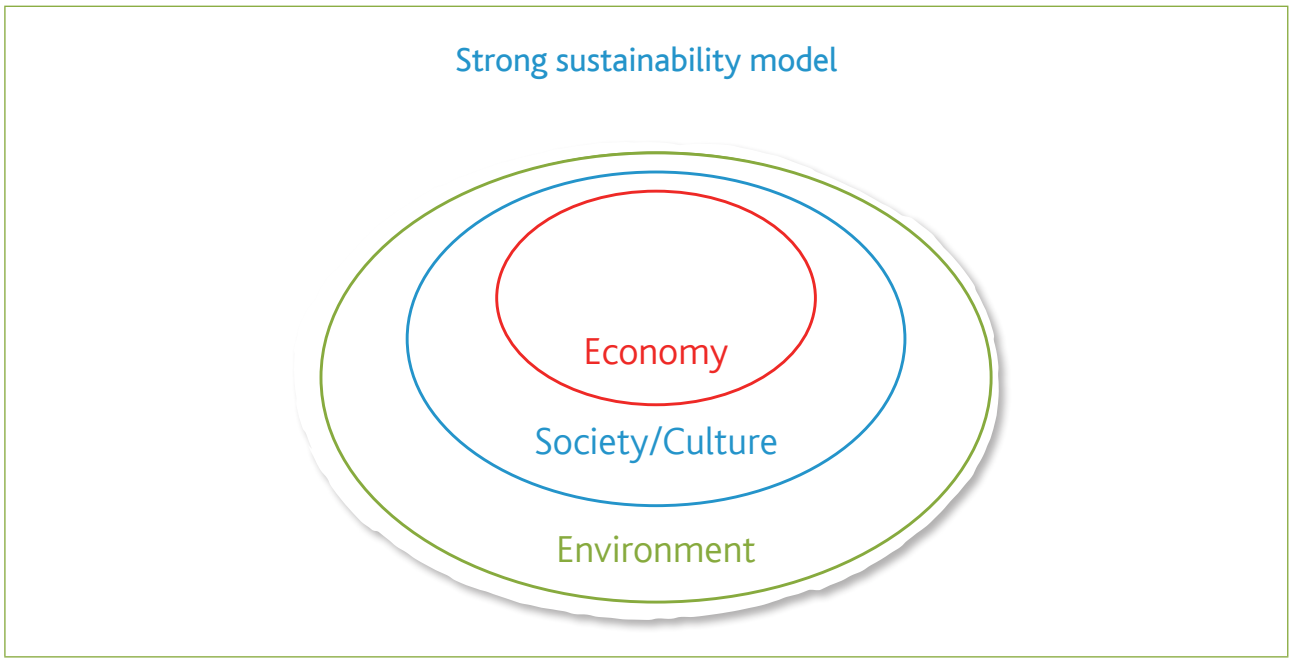
Identify how important stormwater is to you:

Place an **X** on the continuum below.



Name: _____

Identifying different values of stormwater



For each of the people/groups listed below, match the aspect of sustainability that they are most likely to value. Draw a line to connect them - you may use aspects more than once.

Note: This is a generalisation and may not apply to every member of the group.

Group linked with stormwater	Aspect of sustainability
Mana whenua Auckland Council Project Twin Streams stormwater engineers in the past stormwater engineers now Wai Care Catholic Christian Church local residents	social sustainability environmental sustainability economic sustainability cultural sustainability

Name: _____

Task 1: Examine the characteristics of different personal values (own and others) and the behaviours associated with them about stormwater

Choose two of the groups from the previous page. For each group, use the space provided to explain the values that the group holds and how it supports the aspect of sustainability in relation to stormwater.

In your answer think about their role in the community and what is important to them. Use examples to show how these values are reflected in their behaviour and actions in regard to stormwater (If there is not enough space below, use a refill sheet).

Group 1:

_____

Examine the values that this group holds in regard to stormwater.
Include why the aspect(s) of sustainability is important to them.

_____

_____

_____

_____

_____

_____

_____

Use examples to examine the behaviours associated with their values.

_____

_____

_____

_____

_____

_____

_____

Name: _____

Group 2:

Examine the values that this group holds in regard to stormwater.
Include why the aspect(s) of sustainability is important to them.

Use examples to examine the behaviours associated with their values.

Name: _____

Use examples to examine your own values and behaviours associated with stormwater and the environment.

Name: _____

Task 2: How do these values and associated behaviours impact on the sustainability of stormwater in Auckland, now and in the future?

For each of the two groups draw justified conclusions about how or why different personal values and behaviour (i.e. actions) affect stormwater and its impact on the sustainability of the environment.

In your answer:

- explain how each group affects/manages/influences stormwater
- explain the implications of each group's action on the environment, (e.g. streams, biota) and its sustainability in the future
- use specific information in your answer.

Group 1:

Name: _____

Group 2:

Name: _____

Task 3: For the group(s) you have chosen justify how or why different personal values and behaviours are more likely to lead to a sustainable future.

Explain the similarities and differences of the values and associated behaviours these two groups hold. In your answer consider the implications for sustainability in the Auckland region. You may use diagrams, models and bullet points to support your answer and could include projections of future impacts and discussion of how and why values could be adapted to support a more sustainable future.

Name: _____

Task 4: Identify your value of stormwater

Identify how important stormwater is to you:

Place an **X** on the continuum below.

has no importance at all | not really important | it has some importance | quite important | very important

Name: _____

Write a letter to your local newspaper, outlining the following:

a) Explain how your values in relation to stormwater have been influenced or not by investigating the issue associated with stormwater in your local area.

b) Justify why your values have or have not changed over time.

c) Explain how your values in relation to stormwater affect your behaviour.

d) Draw conclusions about how your behaviour affects your local catchment and its sustainability in the future. Your discussion may include justifying decisions, making judgements, stating opinions, considering implications, projecting future impacts, evaluating options, comparing and contrasting, analysing or suggesting alternatives, as appropriate.

Name: _____

Name: _____

Assessment Schedule: What's up my Stream?

Task	Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
	Demonstrate understanding of how different personal values have implications for a sustainable future.	Demonstrate in-depth understanding of how personal values have implications for a sustainable future.	Demonstrate comprehensive understanding of how personal values have implications for a sustainable future.
1	The characteristics of at least two different personal values are examined including their own. • *Respect for the waterways as part of a bigger environmental system whereby the stream needs to be cared for and stormwater runoff managed. e.g Riparian planting.* • *Economic value of the land whereby the stream must not lower the price of the property, e.g piped underground.* • *Hauora -the balance of a healthy environment and community e.g. people are aware of the impact of stormwater and do not dump toxins down drain.*	As for achieved.	As for achieved.
2	For each of the two groups examples are used to examine the behaviours associated with the values: *e.g Wai Care – monitoring with the community to raise awareness and give knowledge and data on which to base decisions. For improvements like fencing and riparian planting to protect streams from erosion and fertiliser runoff, as well as to provide shade, shelter and food for aquatic species.*	As for achieved.	As for achieved.

Task	Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
	Demonstrate understanding of how different personal values have implications for a sustainable future.	Demonstrate in-depth understanding of how personal values have implications for a sustainable future.	Demonstrate comprehensive understanding of how personal values have implications for a sustainable future.
3	Conclusions stated about the implications at least 2 personal values and behaviours for a sustainable future. They may have also commented on those values and/ or behaviours that currently do not support sustainability outcomes. *Because Wai Care values environmental sustainability and works with the community to raise awareness about the effect of stormwater as well as supports them to participate in actions like riparian planting the impact of stormwater on streams will be reduced. if the stream becomes healthier there will be more life in the stream which will contribute to a healthier ecosystem and also reduce pollution into the sea.*	For each of the two groups, informed conclusions are drawn based on examples and evidence about why certain values (own and others)and behaviours around stormwater have implications for a sustainable future. *e.g. Project Twin Streams values community participation and therefore works to involve the community in improving the stream and reducing the impact of stormwater. This active engagement in working together for a common environmental goal increases awareness and ownership of the local environment and therefore fosters a respect now and in the future. Actions that arise from our of caring for a local waterway will be a continued line - planting of the waterway to improve water quality and other actions to raise the profile of the stream with more local residents, so they understand their own actions, e.g. car washing increasing pollution like phosphates in the stormwater and eventually the waterways to the harbours.*	Conclusions are justified based on examples and evidence about how or why some different personal values (own and others) and behaviours around stormwater are more likely to lead to a sustainable future than others. *e.g. Regional councils have always wanted to protect the waterways but in the past have used technology to reduce the impact of stormwater on the waterways and surrounding land. Regional councils have laws to uphold and value legislation as a means of ensuring compliance. There has been a shift in valuing a shared responsibility and a commitment to support social values inherent in a community taking responsibility for its actions. Therefore council works more collaboratively with the community to educate about sustainable behaviour now and for the future as community will share these values with their children.*

Task	Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
	Demonstrate understanding of how different personal values have implications for a sustainable future.	Demonstrate in-depth understanding of how personal values have implications for a sustainable future.	Demonstrate comprehensive understanding of how personal values have implications for a sustainable future.
4	Conclusions are drawn about their own value of stormwater and the environment and the implications for a sustainable future. Has identified values they believe they hold on stormwater and implications for a sustainable future. *My value has changed on stormwater as through education and being made aware of the impact of stormwater on the local stream. I now am more careful about what my family puts down the drain as I respect my community and want it to be a place of beauty and not polluted so we can all get into the environment to appreciate it and also learn how to care for it for our future generations.*		

The examples above relate to only part of what is required, and are purely indicative.

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.

Please refer to assessment schedules for internal assessment resources for examples of student responses.

ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards/Social-sciences/Education-for-sustainability/Level-2-Education-for-sustainability

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

INTERNAL ASSESSMENT RESOURCE: EFS 3.5 (2015)

Education for Sustainability (EfS) Level 3

Supports internal assessment for Achievement Standard: 90832

Credits: 5

Stormwater Strategy – Stepping up for Stormwater
Develop a strategy for an organisation that will contribute to a sustainable future.

This resource has been generated by Auckland Council with Auckland schools. Assessment resources are still to be moderated. It is provided for educational purposes only for the aligned Education for Sustainability Achievement Standards. It is based on the learning objectives from seniorsecondary.tki.org.nz/Social-sciences/Education-for-sustainability

Teachers must manage authenticity for any assessment from a public source, because students may have access to assessment schedule or student exemplar material. Using this assessment resource without modification may mean that students't work is not authentic.

TEACHER GUIDELINES

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Context/setting

Students will need the opportunity to learn about:

- aspects of sustainability in relation to stormwater including Maori concepts related to the environment
- systems thinking
- strategies for a sustainable future
- policy and practices around stormwater management
- research and data analysis
- reflective practice.

It is expected that this activity will come at the end of a learning module focussed around understanding the needs of organisations as they try to act more sustainably in terms of stormwater. Many organisations within Auckland are responding to local government policy and legislation to do with stormwater discharge and sustainable practices.

aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/stormwaterindustryprofessionals.aspx

An organisation could include, but is not limited to, a local business, a household, a local council, a local board, a government agency, a NGO or a school. The organisation may be the student's own school or a nearby kindergarten, primary, or intermediate school.

A partnership must be established. The student or students are required to collaborate with a partner or stakeholder to address a common goal. The partner would be someone directly involved in the implementation of the proposed strategy, should it be accepted i.e. someone in a management role. It is important that students demonstrate active participation skills to competently contribute to discussions, share knowledge, build consensus, assess needs, and manage roles and responsibilities. It may be advisable to prepare stakeholders in advance to work with students and understand expectations.

As they develop a strategy, the partners must identify needs and emerging trends. The proposed strategy should be framed around aspects of sustainability – environmental, social, economic, and cultural. It could entail working with tools used by organisations such as Landcare Research – Manaaki Whenua.

landcareresearch.co.nz/science/living/cities,-settlements-and-communities/urban-stormwater-management

Students will also need to understand how to engage reflectively with their learning. It is expected that students will use a learning journal (in whatever format) to capture their thoughts and ideas on the collaborative process that they have undertaken to develop this strategy. The teacher and/or partner is/are required to observe and record some indicators/ evidence of participation and contribution by the student with the partner. The student must provide this collected evidence on the due date.

Conditions

This activity will take place over a period of six to eight weeks with class time set aside to introduce and discuss the requirements of the assessment as well as for the establishment phase. Students will then need to meet milestone deadlines as negotiated in order to complete the tasks by the due date.

Resource requirements

Students should have access to internet capable computers, telephones and faxes. Exemplars of strategies developed by organisations should be shown and discussed with students. It may also be useful to have a list of organisations willing to enter into short-term collaborative partnerships so that students do not get 'knocked back' in the first instance.

Organisations to partner with:

- student's own school
- local primary schools or kindergartens
- marae and/or local hapu or iwi
- local council
- local boards
- local businesses e.g. security companies with car fleets
- farmers
- concrete industry
- old age homes
- rugby or sports clubs for carpooling
- lawn mower contractors
- golf courses
- car valets
- industry
- developers and builders
- community groups
- businesses where students have part time jobs
- cafes and shops.

Resources

The following are useful references for both teacher and student use.

Sustainability

NZ Business Council for Sustainable Development: nzbcsd.org.nz/

Ministry for the Environment – Simply Sustainable: mfe.govt.nz/fresh-water/tools-and-guidelines

Auckland Council Stormwater guidelines: content.aucklanddesignmanual.co.nz/design-thinking/wsd/Documents/20032015%20GD04%20WSD%20Guideline%20Document.pdf

World Business Council for Sustainable Development: wbcsd.ch/

Strategy

slideshare.net/earlstevens58/7-guide-to-writing-a-strategic-plan

Name: _____

INTERNAL ASSESSMENT RESOURCE

Achievement Standard Education for Sustainability 90832:
Develop a strategy for an organisation that will contribute to a sustainable future.

Subject reference: Education for Sustainability 3.5
Resource title: Stormwater Strategy – Stepping up for stormwater

Credits: 5

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
Develop a strategy for an organisation that will contribute to a sustainable future.	Develop an in-depth strategy for an organisation that will contribute to a sustainable future.	Develop a comprehensive strategy for an organisation that will contribute to a sustainable future.

STUDENT INSTRUCTION SHEET

By the end of this assignment you will be able to show that you can:

- effectively establish, a working partnership with an organisation
- collaboratively develop a comprehensive strategy that will improve stormwater runoff and/or improve local waterways
- present the strategy for a sustainable future.

Time: in order to complete this assignment you will be allocated in-class time but you will be expected to complete much of it your own time.

Due: ____/____/____ Late submissions will not be accepted without the permission of the school's Assessment Coordinator.

You are required to use a learning journal (in whatever format) to capture your thoughts and ideas on the collaborative process you have undertaken to develop this strategy.

Dates for conferencing are: _____

Students can work in two ways to collaborate on a stormwater strategy:

1. They may have the opportunity to work with stormwater managers from local government or private business, whereby they can help develop a strategy that **may** focus on infrastructure changes such as landscaping and low impact design stormwater management options.
2. Alternatively, students could work with business or with community organisations to develop a strategy around behaviour and design that will minimise stormwater contamination and engage people in understanding the importance of waterways.

You will need to collaborate to develop a comprehensive strategy for your school or an organisation in your community that outlines the changes required to contribute to a sustainable future. You will be working collaboratively with people who have a position to make decisions in organisations as your partner(s).

See Unitec for an example: unitec.ac.nz/about-us/environmental-sustainability-strategy

Strategy is a high level plan to achieve one or more goals under conditions of uncertainty.
See en.wikipedia.org/wiki/Strategy

A strategy is important because the resources available to achieve these goals are usually limited.

Max McKeown (2011) argues that "strategy is about shaping the future" and is the human attempt to get to "desirable ends with available means".
See en.wikipedia.org/wiki/Max_McKeown

A strategy could address ways of reducing the harmful effects of stormwater runoff and/or preventing stormwater pollution. This could include investigating flooding, pollution prevention, sediment and erosion control, discharge, transport, litter and waste minimisation, drainage, car washing, landscaping, low impact design device (LIDD) construction or community action.

This process of working collaboratively takes time. You have to be prepared to establish a collaborative working relationship, as well as timeline and milestones with a partner or representative stakeholder group within the school.

As Albert Einstein said: "We cannot solve our problems with the same thinking we used when we created them."

Timeline

The deadline for handing in your strategy is ____/____/____

Milestone meeting one is on ____/____/____

Between meetings: Journal/blog to background the organisation's practices at present.

Milestone meeting two is on ____/____/____

Between meetings: Journal/blog an outline of strategy and links to sustainability.

Final milestone meeting is on ____/____/____

Name: _____

Step 1 - Starting off

- Brainstorm issues of stormwater runoff in your local community.
  (After implementing your action project AS 90810 you may want to design a strategy that will outline how to carry on).

- Identify an organisation that would like to contribute to improving their practice around stormwater.

- Find someone with responsibility within the organisation to discuss stormwater issues.

- Establish the collaborative roles and responsibilities with your partner organisation.
  What will you be responsible for?
  Consider how you may share knowledge and information, plan steps and find consensus as you develop your strategy.

- Establish your learning journal in whatever format is appropriate e.g. e-portfolio, blog or scrapbook. This will be used for your assessment.

Step 2 - Understanding the organisation and the stormwater practices

- Meet with your partner to establish a timeline.
  (If you are unable to meet face to face, you could do this via the phone, email, Skype or your e-portfolio site).

- Describe the core business of the organisation.

- Research the present practices in the organisation in regard to stormwater.
  (include an analysis of stormwater policy and practices).

- Evaluate the organisational practices in terms of a sustainable future.
  The table below is provided as an example that may help to establish some of the actions you need to target.
  Discuss three or more issues relevant to your organisation.

Name: _____

Stormwater issues	Organisation practices	Environmental impact	Social impact	Cultural impact	Economic impact
Local stream quality					
Impervious surfaces					
Flooding					
Contamination: • Discharge • Pollution • Sediment • Litter • Drains					
Erosion					
Existing stormwater infrastructure					
Transport/ car-washing					
Social awareness					
Other					

Name: _____

Step 3 - Strategising

Develop a strategy to address identified needs of the organisation.
The strategy could address flooding, pollution prevention, sediment and erosion control, discharge, transport, litter and waste minimisation, drainage, car washing, landscaping and/or community participation. See landcareresearch.co.nz/science/living/cities,-settlements-and-communities/urban-stormwater-management.

1. Identify why you and the organisation need to become more sustainable. Look at benefits you will make for the environment, economy and for the people involved.

2. Establish the current situation of how sustainable the organisation is now and analyse where there are the biggest gaps or actions to improve.

3. Set a clear and concise vision for your strategy.

4. Propose a range of possible goals/objectives which include measurable outcomes and timelines e.g. we will plant 500 trees on the bank of our local stream by the end of the year. Include the rationale for the objectives you have chosen for your strategy.

5. Design a series of steps or actions that will have the greatest impact in reaching your objectives or goals. The strategy could include new processes and practices, how to use resources, education and working with your team. Outline how these changes will save money or bring people on board or make a difference in other ways to improve sustainability.

6. Describe how you will implement the changes and monitor progress. How will you know if your strategy has been successful and what are the next steps? Identify the advantages and disadvantages of the objectives/goals in terms of sustainability and organisational needs. For strategy writing help: landcareresearch.co.nz/resources/business/environmental-and-services-database.

Step 4: Evaluation and submission

- Relate the proposed objectives/goals to the issue of stormwater.

- Draw insightful conclusions based on evidence about how the strategy will help the organisation address the stormwater issue.

- Submit your strategy as a presentation, report or web page.

- Submit your learning journal.

ASSESSMENT SCHEDULE: EFS 3.5: STORMWATER STRATEGY: STEPPING UP FOR STORMWATER

Task	Evidence for Achieved	Evidence for Achieved with Merit	Evidence for Achieved with Excellence
	Develop a strategy for an organisation that will contribute to a sustainable future.	Develop an in-depth strategy for an organisation that will contribute to a sustainable future.	Develop a comprehensive strategy for an organisation that will contribute to a sustainable future.
1	Evidence of: • Communication with the organisation • A timeline established with a partner • Reflection on the collaborative process with partner (usually in a journal).	As for achieved.	As for achieved.
2	Research of stormwater issue for the organisation using aspects of sustainability. Includes: • An analysis of present practice around stormwater • Data on 3 or more stormwater issues relevant to the organisation.	As for achieved.	As for achieved.
3	A strategy to improve stormwater is developed that includes; • A range of possible objectives • A rationale based on sustainability • Proposal of further actions.	An in depth strategy that includes; Advantages and disadvantages of the objectives in terms of sustainability and organisational needs.	As for merit.

Task	Evidence for Achieved	Evidence for Achieved with Merit	Evidence for Achieved with Excellence
	Develop a strategy for an organisation that will contribute to a sustainable future.	Develop an in-depth strategy for an organisation that will contribute to a sustainable future.	Develop a comprehensive strategy for an organisation that will contribute to a sustainable future.
4	Conclusions about how the strategy will contribute to a sustainable future. It is expected that there will be more than one reason included in this conclusion.	Informed conclusions about why the chosen objectives /goals were selected based on evidence about the organisations current situation.	Insightful conclusions based on qualitative and/or quantitative evidence of about the likely effectiveness of the strategy in addressing the stormwater issue required to contribute to a sustainable future. Insightful could include aspects of systems thinking or original connections, exploration of future implications or use of higher level thinking skills such as analysis or synthesis.

Refer to: ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards/Social-sciences/Education-for-sustainability for examples of student responses

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

JUNIOR SECONDARY PROGRAMME

LEVEL 4–5 'CRIME SCENE INVESTIGATION' STORMWATER

'Crime scene'

In your local catchment there will be crime scene evidence that students can investigate to detect causes and also possible actions for improvement. Students can explore their own impact on waterways and also possible behaviour changes that could help.

pce.parliament.nz/assets/Uploads/PCE-Water-Quality-in-New-Zealand.pdf

Teacher notes

How can you use this resource? The next few pages offer some alternatives for how to use stormwater as a context for learning science.

The Post Primary Teachers' Association (PPTA) curriculum resource bank provides an inquiry unit that teachers can use about streams or adopt a crime scene investigation where students begin to explore the connection between human activity on land and the relationship with waterways and the sea using scientific data as evidence. The PPTA has a teacher-derived resource 'Stream Study for Education for Sustainability.'

ppta.org.nz/index.php/resources/curriculum-support/curric-resources/cat_view/147-curriculum-resources/163-learning-areas--subjects/174-education-for-sustainability

Teachers can use the suggestions on the next page and work to their strength or interest to allow students to investigate specific topics or organise a home and expert jigsaw activity where students choose different areas of research in a home group and work with other experts to share results with all the class across the four science strands.

Achievement objectives

Science

- **Nature of science** – understanding, investigation, communicating in science and participating and contributing.
- **Planet earth and beyond** – investigate the composition, structure, and the features of the geosphere, hydrosphere and atmosphere and interacting systems.
- **Living world** – investigate the interdependence of living things (including humans) in an ecosystem.
- **Material world** – chemical and physical properties of different groups of substances. Chemistry and society.
- **Physical world** – identify and describe.

Education for Sustainability

- **In:** Investigate and collect scientific data in the local catchment.
- **About:** Research the effect humans have on the science of our streams and harbours.
- **For:** Carry out action to improve the quality of the water in our catchments.

Social science

- Understand how people interact with natural environments and that this interaction has consequences.
- Understand how, as a result of scarcity, consumers, producers and governments make choices that affect New Zealand society.

Baseline data: Describing the 'crime scene'

What are the crimes in our harbours and how does it link to your local catchment?

Auckland Harbours – Manukau and Waitematā.

aucklandcouncil.govt.nz/EN/AboutCouncil/representativesbodies/haurakigulfforum/Documents/hgfexecutivesummary2011.pdf

Describe your local catchment.

aucklandcouncil.govt.nz/EN/ratesbuildingproperty/propertyinformation/GIS_maps/Pages/Home.aspx

What is the geology of my catchment?

stateofauckland.aucklandcouncil.govt.nz/report-type/soil-report-card/

stateofauckland.aucklandcouncil.govt.nz/report-type/terrestrial-report-card/

What is stormwater and how does it affect our harbours?

aucklandcouncil.govt.nz/EN/environmentwaste/stormwater/Pages/stormwaterandyourhome.aspx

Investigations: 'Crimes' on our harbours

Teachers could investigate the ideas around each box on the next page, or could coordinate students to investigate the science around one idea and then present to the rest of the class. There is plenty of opportunity for hands-on investigations in each.

The diagram over the page provides options for investigations on the 'crimes' on our streams and harbours!

Students could design an inquiry around one of these topics using 5W's and an H. (What? Where? When? Why? How?) to investigate properties and changes of matter, chemistry and society that each causes to our waterways. Teachers could support student's understanding with investigations in the classroom. E.g. dissection of a fish gill, effect of fertiliser on algae growth, simulation of urban run-off, acids and bases and solubility.

From deeper investigation students could then make connections about the impacts on biodiversity, habitat, breeding grounds, mahinga kai and kai moana.

‘Crimes’ on our streams and harbours

Students could conduct an inquiry into one of the contexts listed and how they are a crime on the harbour. They could design and model a demonstration to show effect.

Stormwater
- affected by urban growth and impermeable surfaces
- impacts stream ecosystems
- impacts turbidity, temperature and pH
- impacts flow rates.

Sedimentation
- affected by land use
- affected by heavy metals
- affected by erosion
- impacts on mangroves
- impacts gills of fish and macroinvertebrates.

Nutrient pollution
- from phosphates
- from nitrates
- causes oxygen depletion
- causes eutrophication
- impacts ecosystems.

Pollution and pathogens
- from farming run-off and sewage overflows
- from litter and debris
- impacts species and habitats.

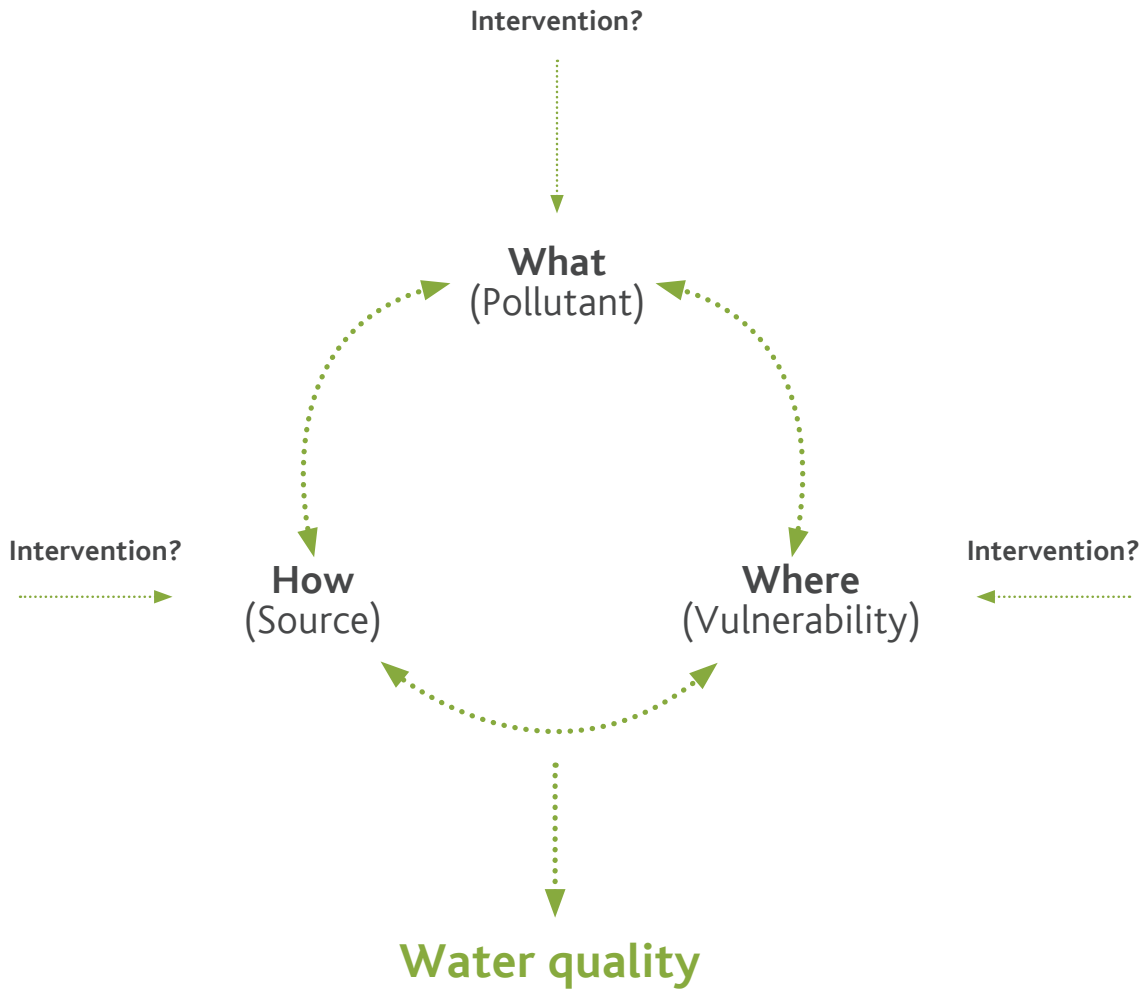
Which suspect is guilty?

Who did it?

Thinking through the science of water quality problems – students can use the diagram below to look at causes and effects of stream degradation from the evidence they discover on site. This diagram can support them to think of ways to stop pollution at the source, e.g. plastic as a pollutant can be reduced or prevented from getting into waterways by collecting and recycling, as it will end in the sea.

Source: Parliamentary Commissioner for the Environment: Water Quality in New Zealand – Understanding the Science. March 2012, Figure 9.1, page 73.

Interventions – what can be done about it?



How to solve the crime

Through their research, students could come up with action plans to improve the stream and reduce pollution. Possible actions could be integrated into other learning areas for raising awareness about the future of our streams and harbours. Examples are speeches, persuasive writing, graphic design, videos, music, art or drama. Below are resources to support students to take action.

Student resources


sustainablecoastlines.org/Kia_Ora/Welcome___Projects_to_sustain_and_protect_our_coastlines/Welcome___Projects_to_sustain_and_protect_our_coastlines.html


waicare.org.nz/Home.aspx


sciencelearn.org.nz/Contexts/H2O-On-the-Go/NZ-Research


gw.govt.nz/take-action-for-water


boprc.govt.nz/residents/teachers/teacher-resources/waiora-healthy-water/


waikatoregion.govt.nz/Services/Regional-services/For-schools/Resources-for-teachers/

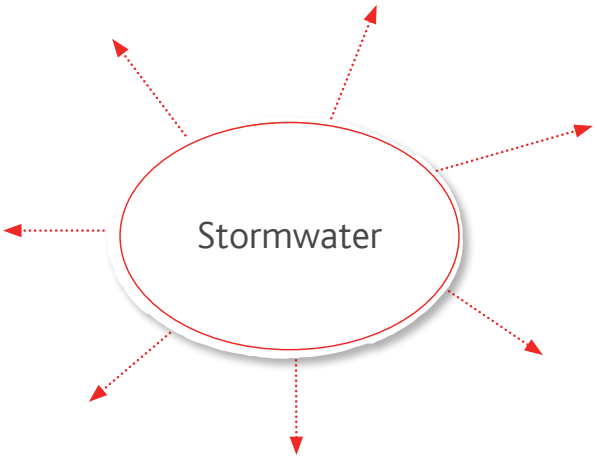

ecan.govt.nz/advice/your-school/lesson-resources/Pages/water.aspx

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

RESOURCES

STORMWATER MIND MAP

Write what you already know about:



Where is your closest stream? (Road name) _____

Have you visited a stream on a study trip before? _____

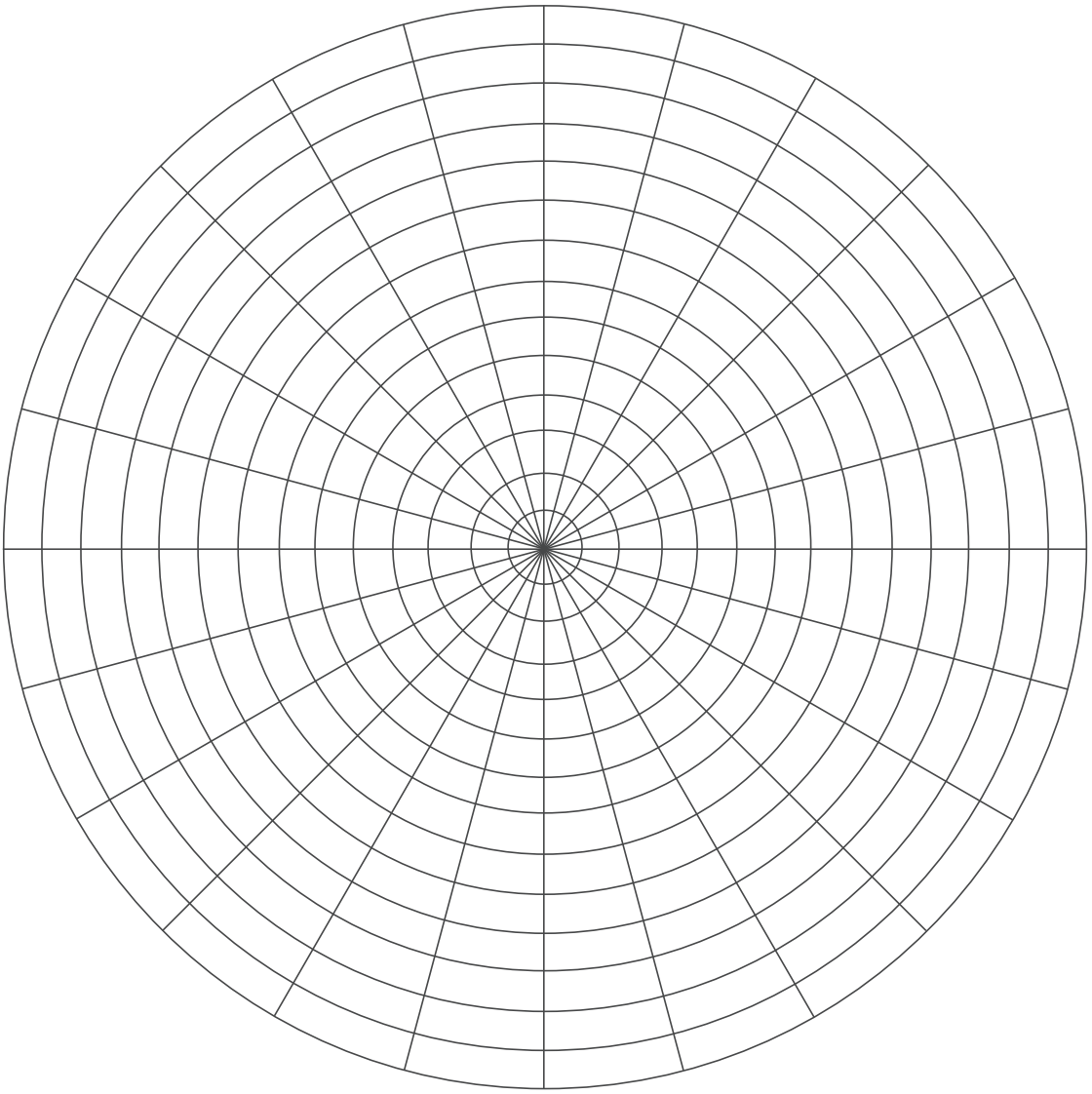
Stream name (if known): _____

SOUND LOG

Where are you? What can you hear? Where did the noise come from?

Record it here.

This sound log was taken at: _____



Listening closely here made me: _____

ACTIVITY TO DECIDE ON ACTIONS FOR SUSTAINABILITY FOR STORMWATER

Teacher rationale

Here is a sample of cooperative learning strategies that will help students to reflect on what they have learnt and collaboratively identify problems with stormwater in their catchment. The students will then prioritise issues they feel are important and collectively suggest relevant actions. Then they will choose appropriate action for their group using the decision making grid and establishing criteria. (Please use the list of possible actions only if needed by the students, otherwise let students come up with their own ideas).

Group brainstorm issues

(adapted from Chris Rowan – Impact Education)

Students split into groups of four, seated at tables where they can face each other.

Equipment:

- large pieces of paper
- a different coloured pen for each student.

Give students one minute of thinking time and then five minutes for each student in turn to write down a different problem with stormwater that they have learnt about from their work to date. Be specific, e.g. erosion, sediment in streams.

Carry on until each student has written down all their ideas. Each student can say 'pass' once.

One stay, three stray

(adapted from Chris Rowan – Impact Education)

- One person is randomly selected to stay at their table with the group's ideas to present to others and clarify points.
- The other three students go to other tables and share their ideas.
- Each student collects three more ideas to bring back to their original group.
- Students return to original group, share ideas, and record onto the group sheet.

Student instructions – change research to action

- In your group decide on stormwater, stream, and harbour issues that are of interest to you.
- Share ideas or research possible actions that will improve the issue.

Consequence wheel

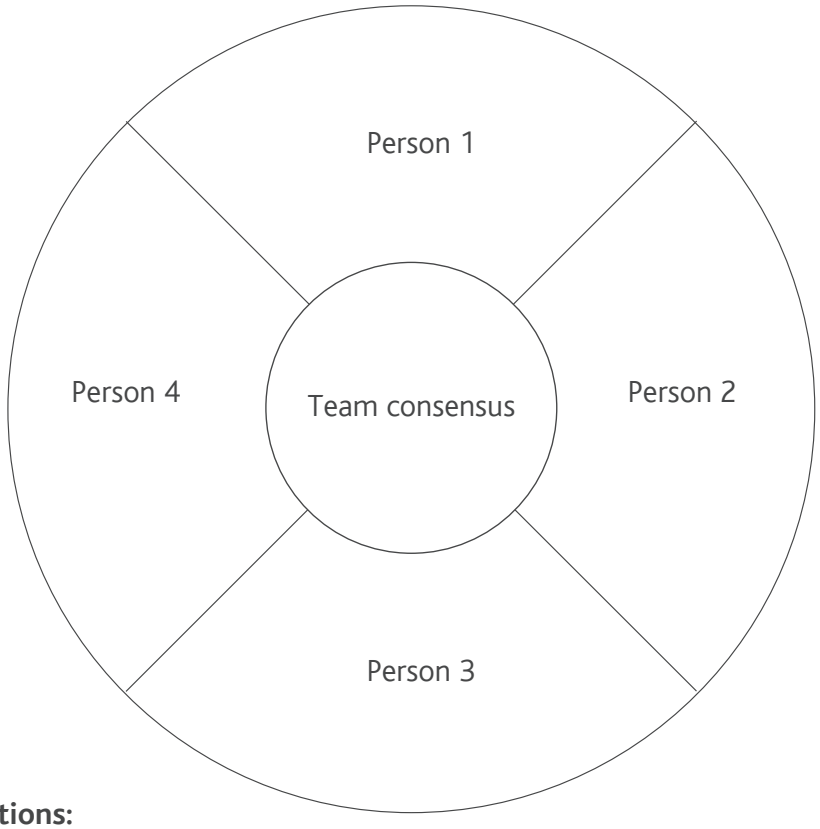
Students could use a consequence wheel to identify future impacts of either the specific issue or the action they choose to understand future consequences.

efs.tki.org.nz/Curriculum-resources-and-tools/Teaching-Tools

Consensus mat

(adapted from Chris Rowan – Impact Education)

Each person uses the consensus mat to individually write down three actions they would like to be involved in. The group then decides which action most people agree on. If there is no consensus, students can move to another group.



Decide which actions:

- prevent the problem happening, e.g. reducing car use. Mark with a 'p'
- improve the stream water quality, e.g. riparian planting. Mark with an 'i'.

Decision making grids

Students develop criteria to help inform their decision of which action will be the most appropriate for their group in the time available and with the resources they have available. Below is an example that students can rank.

		Criteria				
		Fun	Long term sustainability outcomes	Cost	Time	Involving people
Possible actions	Community planting days					
	Sustainable carwash day					
	Installing a rain water collection tank					
	Video of the story of the stream					
	Creating a rain garden					

Possible stormwater actions

Possible 'actions' that are connected to stormwater management (close to school).

- Designing and building a soak zone for school downpipes.
- Designing and building a green roof for a small school building, such as a porch.
- Getting community participation for riparian plantings. (Wai Care would really appreciate this!)
- Offering a programme of water quality monitoring in the stream, focussing on certain stormwater outlets and publicising results to the community.
- Designing a roof water harvesting system for the new community garden the school is building.
- Raising seedlings in the propagation unit for riparian planting.
- Creating awareness in the community about actions that help the stream. Plan a celebration/planting/advertising poster or card/performance.
- Making a video to raise awareness in the community.
- Creating a 'no car day' or sustainable transport day to link transport to stormwater.
- Starting carless days at your school.
- Using rubbish from a waste audit at the stream to lobby manufacturers of packaging or specific litter or create a public sculpture with the rubbish and invite a newspaper reporter to publicise it.
- Creating a walkway along the stream that is safe and has information about the waterway/harbour/species.
- Holding a stream festival for the community.
- Supporting community awareness by developing a Facebook page for posting information and inviting people to be part of events.
- Showing a video about the cultural significance of water to mana whenua.
- Creating a lesson plan about the stream and teach it to local kindergartens or primary schools.
- Making a vegetable garden to build resilience about food security and reduce food transport.
- Using organic practices to reduce the fertiliser/pesticide impact on waterways.
- Painting drains.
- Planning and carrying out awareness campaigns to stop household chemicals getting into stormwater drains, e.g. car washing.
- Organising a fashion show to 'adopt a stream macroinvertebrate' to raise awareness about what lives in streams.
- Organising a car wash on a local park so water drains through the grass.
- Organising riparian planting.
- Reducing packaging on school lunches. Putting up posters about how this helps streams.
- Finding out which community organisations are helping keep streams clean.
- Talking to local businesses to see what they do to help reduce their impacts on stormwater.

Name: _____

STORMWATER ACTION PLAN

SMART Action Plan

Vision: In the future we want to see...

Specific. What is your goal?

Measurable. What will you measure? How will you know if you have reached your goal?

Achievable. Is your action too big/too small? Do you need to review it and make changes? Who else needs to be involved?

Relevant. How will it contribute to your vision? What else will you need to find out?

Time frame. How long will you need?

Goal: _____

What steps will you take?	Why?	Who will do it?	When?	How will you know it's done?
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

STORMWATER AND THE ASPECTS OF SUSTAINABILITY

Teacher's notes: An activity to introduce aspects of sustainability to the issue of stormwater in our community.

Society, the economy and culture are the aspects of sustainability that are all connected and dependant on the environment. It is essential that students understand all four aspects of sustainability and their interrelatedness. The two teaching tools below from the EfS kete on Te Kete Ipurangi (TKI) will:

- help students create their own definition of the aspects
- support them to apply them to the context of stormwater.

Please refer to references below for full outlines of the strong sustainability model and activities.

See: Change – Learning and Educating for Sustainability. 2004. Parliamentary Commissioner for the Environment (PCE) "Models of sustainability", page 15.


pce.parliament.nz/assets/Uploads/Reports/pdf/See_change_report.pdf

Teaching tools


efs.tki.org.nz/Curriculum-resources-and-tools/Sustainability-Jigsaw


efs.tki.org.nz/Curriculum-resources-and-tools/Aspects-of-Sustainability-a-graphic-organiser

Contact efs.administration@aucklandcouncil.govt.nz for:

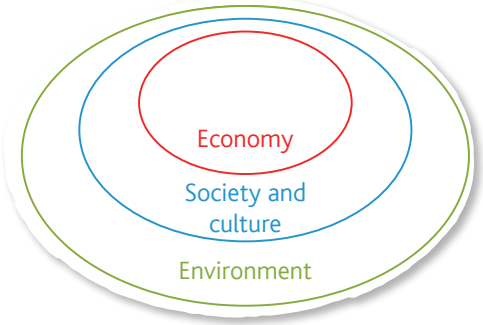
- stormwater poster
- The Guardians of the Mauri DVD/Nga Kaitaiaki o te Mauri DVD.

Introduction

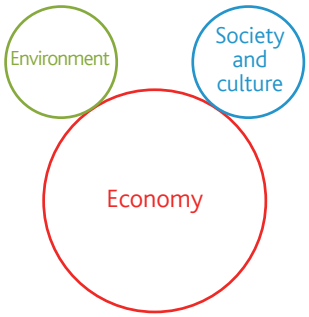
1. Think/pair/share on the meaning of sustainable future. 'Sustain'- 'able.'
2. Discuss with your class about the future they prefer for themselves, their children, and their whanau. Discuss who is responsible for the future. Complete a continuum about their responsibility in creating that future.

   (Strongly agree it's my responsibility.....Strongly disagree)
3. Carry out the sustainability jigsaw activity. Provide one puzzle for a group of 4-5. Discuss the **aspects of sustainability,** environment, social, cultural, and economics and their interdependence. Which aspect could we not survive without? Use the reflective questions in groups.

Strong sustainability model



Mickey mouse model



4. Decision making. Compare the strong sustainability model with the 'pig' or 'mickey mouse' model, see sustainability jigsaw and PCE link. What has been the main priority for decisions since the industrial revolution? Can this last into the future, why or why not?
5. Optional: Students could brainstorm issues they face in their lives. Get them to place them on the strong sustainability model to identify if they are environmental, social, economic, or cultural issues. Discuss making connections across all the aspects to show interrelationships.
6. Look at the aspects template on the next page. In pairs, write on the aspects template anything about stormwater that affects the environment, society, the economy and culture. If some ideas fit in more than one aspect then you can draw arrows to link them.
7. Which aspect did you have the least ideas about in relation to stormwater?
   - Create two inquiry questions to find out more about this aspect in regard to waterways and the impact of stormwater, e.g. what is the significance of our stream to local iwi? How much would it cost for factories not to pollute the stormwater?
   - Who could you ask? Give students time to research, phone, interview, or talk to relevant people to fill in the grid.
8. Students can use this template to write paragraphs explaining the reason why actions need to be taken and the impact of the issue on their community and their city.
9. Students could also use aspects when making decisions about solutions and include actions to address people, culture, the economy as well as the environment.

STORMWATER ASPECTS

Environmental

Cultural

Social

Economic

STREAM/WETLAND FOOD WEB EXPERIENTIAL ACTIVITY

Purpose: To generate conversation through students using species names and making connections to link food chains.

This activity can be left open for students to find relationships by talking to each other within a pyramid-defined space so they understand the biomass of a food web.

Otherwise, teachers can take more control and create definite food chains that can then be linked together as a web. (Teachers can sort cards for their appropriate class size).

Hand out a card to each student and get them to look at species. Then holding the picture up in front of them they can look at the back and identify the organism's role in the ecosystem and note what they eat and what eats them.

They can then talk to each other and find the links and create a food web. Get each student to state which animal or plant they are role playing and the ecological niche of that organism.

Once the food web is constructed, teachers can use it to identify trophic levels and use scenarios to look at interrelationships and future consequences.

Scenarios – what happens if?

1. After a sudden storm event there has been an overflow of stormwater and sewage from pipes and the level of bacteria has increased to dangerous levels in the stream. When the dissolved oxygen content in the stream is low, the native fish and many species of macroinvertebrates (except for the more tolerant species) will die, bacteria numbers may increase at local beaches and the sea may not be suitable for swimming in. Check Safeswim on the Auckland Council website for updates.

2. Ten years after a community riparian planting project the stream is now shaded and cooler with less sediment from eroding banks. It's likely that the water quality will have improved and dissolved oxygen levels may have increased if the stream is cooler, allowing less tolerant species like mayfly and caddis fly larvae to return to the stream.

3. A new development has started upstream and there has been a large amount of sediment in the stormwater outlets. The algae that many of the stream insects eat will die and the gills of macroinvertebrates like caddisflies and stoneflies will become clogged.

4. Fertiliser is running into the stream and increasing the nitrogen and phosphate levels which increase the growth of algae and pond weed. This then causes dissolved oxygen stress during the night which stresses fish and macroinvertebrates.

5. *Gambusia*, an exotic fish species have got into the waterway and are attacking native fish and are competing for food. They have a high reproductive rate and are also more tolerant of poorer water quality than native fish.

6. A new park manager for an inner city community development has day-lighted a previously piped stream, reducing flow rates and erosion, thereby improving water quality in the downstream parts of the stream.

7. Road run-off is filtered through swales reducing heavy metals and oil from getting into the stream, as well as cooling the water.

8. A new shopping centre with large car parks has been built. The roofs and car park get hot in summer so run-off from summer storms heats up the stream water and reduces the amount of dissolved oxygen available.

The cards can be used in many ways:

- what am I?
- photos can be used to identify specific adaptations and features.

Students can create scenarios and then discuss effects on different species and the ecosystem as a whole. The water quality of run-off into estuaries and the harbours can be predicted.

- Use **the consequence wheel** for this activity.

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

Food Web Cards

WOODY DEBRIS

LEAF LITTER

WATERCRESS

SUBMERGENT MACROPHYTES

ALGAL BLOOM

WATERCRESS

Macrophytes – emergent

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
0.2m-1m

SUBMERGENT MACROPHYTES

Macrophytes – submergent

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
0.2m-1m

ALGAL BLOOM

Unicellular planktonic

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
Microscopic

AUCKLAND SCHOOLS ARE INVITED TO CONTACT AUCKLAND COUNCIL FOR FURTHER SUPPORT.

Email: efs.administration@aucklandcouncil.govt.nz
Victi: aucklandcouncil.govt.nz

Auckland Council
Te Kaunihera o Tāmaki Makaurau

WOODY DEBRIS

Terrestrial vegetation

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
>1m

LEAF LITTER

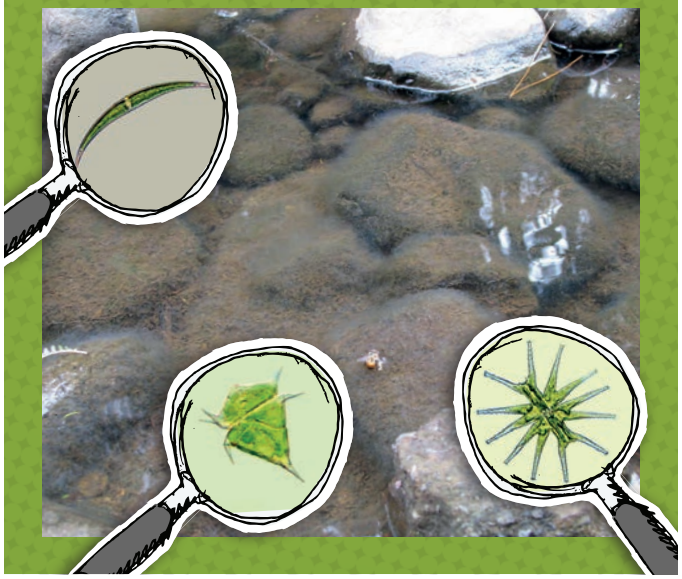
Terrestrial vegetation

Feeds by
Photosynthesising sunlight

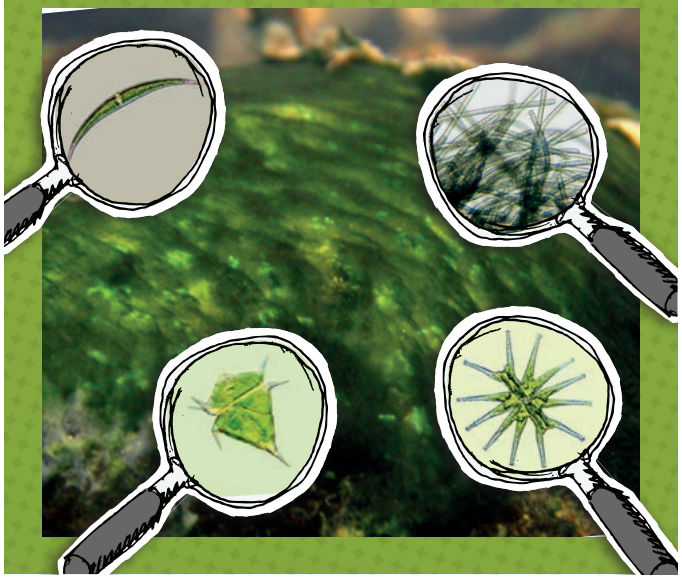
Is food for
Invertebrate grazer

Size
0.2m-1m

ALGAL FILM



ALGAL MAT



FLAMENTOUS ALGAE

IRON BACTERIA

MAYFLY LARVA

FRESHWATER SNAIL

IRON BACTERIA

Bacteria

Feeds by
Forms when oxygen, water and iron combine.

Is food for
Invertebrate grazer

Size
Microscopic

MAYFLY LARVA

Invertebrate grazer

Feeds by
Unicellular algal films

Is food for
Invertebrate or fish predators

Size
0-2cm

FRESHWATER SNAIL

Invertebrate grazer

Feeds by
Unicellular algal films

Is food for
Invertebrate or fish predators

Size
0-2cm

ALGAL FILM

Unicellular film

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
Microscopic

ALGAL MAT

Unicellular mat

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
Microscopic

FILAMENTOUS ALGAE

Filamentous

Feeds by
Photosynthesising sunlight

Is food for
Invertebrate grazer

Size
0-2cm

LATIA LIMPET

POYAMOPYRGUS SNAIL

WOODY-CASED CADDISFLY LARVA

FRESHWATER CRAYFISH

FRESHWATER SHRIMP

FRESHWATER MUSSEL

FRESHWATER CRAYFISH

Invertebrate shredder

Feeds by
Coarse organic debris, leaflitter,algae (unicellular and filamentous), invertebrates

Is food for
Invertebrate or fish predators

Size
2-20cm

FRESHWATER SHRIMP

Invertebrate shredder

Feeds by
Coarse organic debris, leaflitter, algae (unicellular and filamentous)

Is food for
Invertebrate or fish predators

Size
2-20cm

FRESHWATER MUSSEL

Invertebrate filterer/collector

Feeds by
Fine organic debris, unicellular algae, bacteria

Is food for
Mammal predator

Size
2-20cm

LATIA LIMPET

Invertebrate grazer

Feeds by
Unicellular algal films

Is food for
Invertebrate or fish predators

Size
0-2cm

POTAMOPYRGUS SNAIL

Invertebrate grazer

Feeds by
Unicellular algal films

Is food for
Invertebrate or fish predators

Size
0-2cm

WOODY-CASED CADDISFLY

Invertebrate grazer

Feeds by
Coarse organic debris, leaflitter, algae (unicellular and filamentous)

Is food for
Invertebrate or fish predators

Size
0-2cm

COLOBURISCUS MAYFLY

NET-SPINNING CADDISFLY LARVA

AMELETOPSIS MAYFLY LARVA

DOLEMEDES SPIDER

DRAGONFLY LARVA

DRAGONFLY

DOLEMEDES SPIDER

Invertebrate predator

Feeds by
Invertebrates

Is food for
Bird omnivore or mammal omnivore

Size
2-20cm

DRAGONFLY LARVA

Invertebrate predator

Feeds by
Invertebrates

Is food for
Invertebrate or fish predators

Size
0-2cm

DRAGONFLY

Invertebrate predator

Feeds by
Invertebrates

Is food for
Invertebrate or fish predators

Size
2-20cm

COLOBURISCUS MAYFLY

Invertebrate filterer/collector

Feeds by
Fine organic debris, unicellular algae, bacteria

Is food for
Invertebrate or fish predators

Size
0-2cm

NET-SPINNING CADDISFLY LARVA

Invertebrate filterer/collector

Feeds by
Fine organic debris, unicellular algae, bacteria, leaflitter

Is food for
Invertebrate or fish predators

Size
0-2cm

AMELETOPSIS MAYFLY LARVA

Invertebrate predator

Feeds by
Invertebrates – mayfly and caddisfly larvae

Is food for
Invertebrate or fish predators

Size
0-2cm

CRANS BULLY

BANDED KOKOPU

EEL

GOLDEN BELL FROG

HOCHSTETTERS FROG

KOI CARP

GOLDEN BELL FROG

Amphibian predator

Feeds by
Invertebrates

Is food for
Bird omnivore

Size
2-20cm

HOCHSTETTERS FROG

Amphibian predator

Feeds by
Invertebrates

Is food for
Bird omnivore

Size
2-20cm

KOI CARP

Fish ominivore

Feeds by
Macrophytes and invertebrates

Is food for
Mammal omnivore or energy for decomposers

Size
0.2m-1m

CRANS BULLY

Fish predator

Feeds by
Invertebrates and small fish

Is food for
Eel or koi carp

Size
2-20cm

BANDED KOKOPU

Fish predator

Feeds by
Invertebrates and small fish such as bullies

Is food for
Eel or koi carp

Size
2-20cm

EEL

Fish predator

Feeds by
Invertebrates or birds – chicks

Is food for
Mammal omnivore or energy for decomposers

Size
0.2m-1m

PUKEKO

DUCK

SWAN

STOAT

MOUSE

PEOPLE

STOAT

Mammal predator

Feeds by
Mice and eggs

Is food for
Provides energy for decomposers

Size
0.2m-1m

MOUSE

Mammal omnivore

Feeds by
Fish eggs

Is food for
Mammal omnivore or energy for decomposers

Size
2-20cm

PEOPLE

Mammal omnivore

Feeds by
Ducks, eels, kokopu (when whitebait), crayfish and watercress which is a water plant macrophytes

Is food for
Provides energy for decomposers

Size
>1m

PUKEKO

Bird omnivore

Feeds by
Macrophytes, invertebrates, fish, mice

Is food for
Bird omnivore

Size
0.2m-1m

DUCK

Bird omnivore

Feeds by
Macrophytes, invertebrates and filamentous algae

Is food for
Mammal omnivore or energy for decomposers

Size
0.2m-1m

SWAN

Bird omnivore

Feeds by
Macrophytes, invertebrates and filamentous algae

Is food for
Mammal omnivore or energy for decomposers

Size
0.2m-1m

THE CONSEQUENCE WHEEL

The learning context

A consequence wheel supports students to think reflectively and creatively by encouraging them to consider a range of possible 'consequences' to a particular event, issue or idea. It can be used as a whole class, small group or individual strategy depending on the ability and confidence of students.

It is strongly recommended that teachers scaffold the use of the strategy by providing a model for students to consider, developing one together in a shared demonstration and then giving students the opportunity to explore the strategy for themselves, first in pairs or small groups and eventually independently. It enables students to evaluate and reflect on a given situation or potential action and inform their own decision making and choices.

Source: This has been adapted from Education for Sustainability TKI website: efs.tki.org.nz

Student learning outcomes

Possible learning outcomes from using this tool:

thinking about and relating to a situation from different perspectives

understanding that any event, issue or idea has consequences for others and the environment

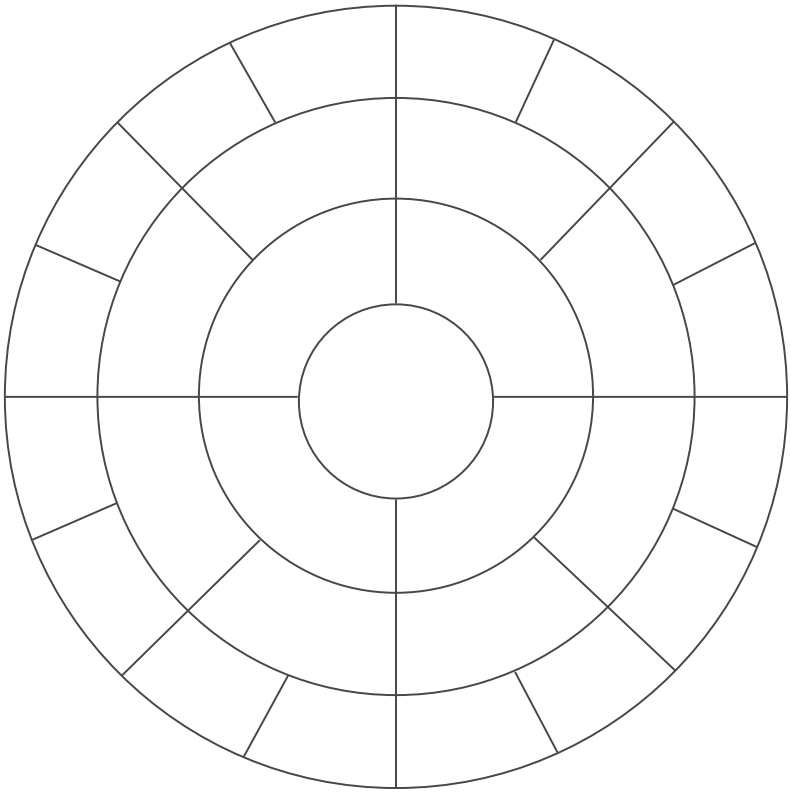
collaborating with others to build new knowledge

thinking critically before making decisions.

"I will be able to talk about the consequences of actions and issues from different points of view."

"I will be able to use this information to justify an action."

Learning sequence



In the centre circle place a statement or issue, for example:

- harbours have sediments polluted by heavy metals
  - trees and other large plants are removed from beside streams.

- In each outward radiating section of the circle place ONE consequence of the issue or statement. The consequence can be positive and/or negative from the perspective of those completing the wheel.
- A new 'consequence' is then considered for each of the statements from the inner radiating sections as the wheel works outwards.
- The issue can then be discussed from a range of perspectives and possible consequences to support students considering their own actions and choices.

The quadrants of the wheel could be directed to each aspect of sustainability (see example below).

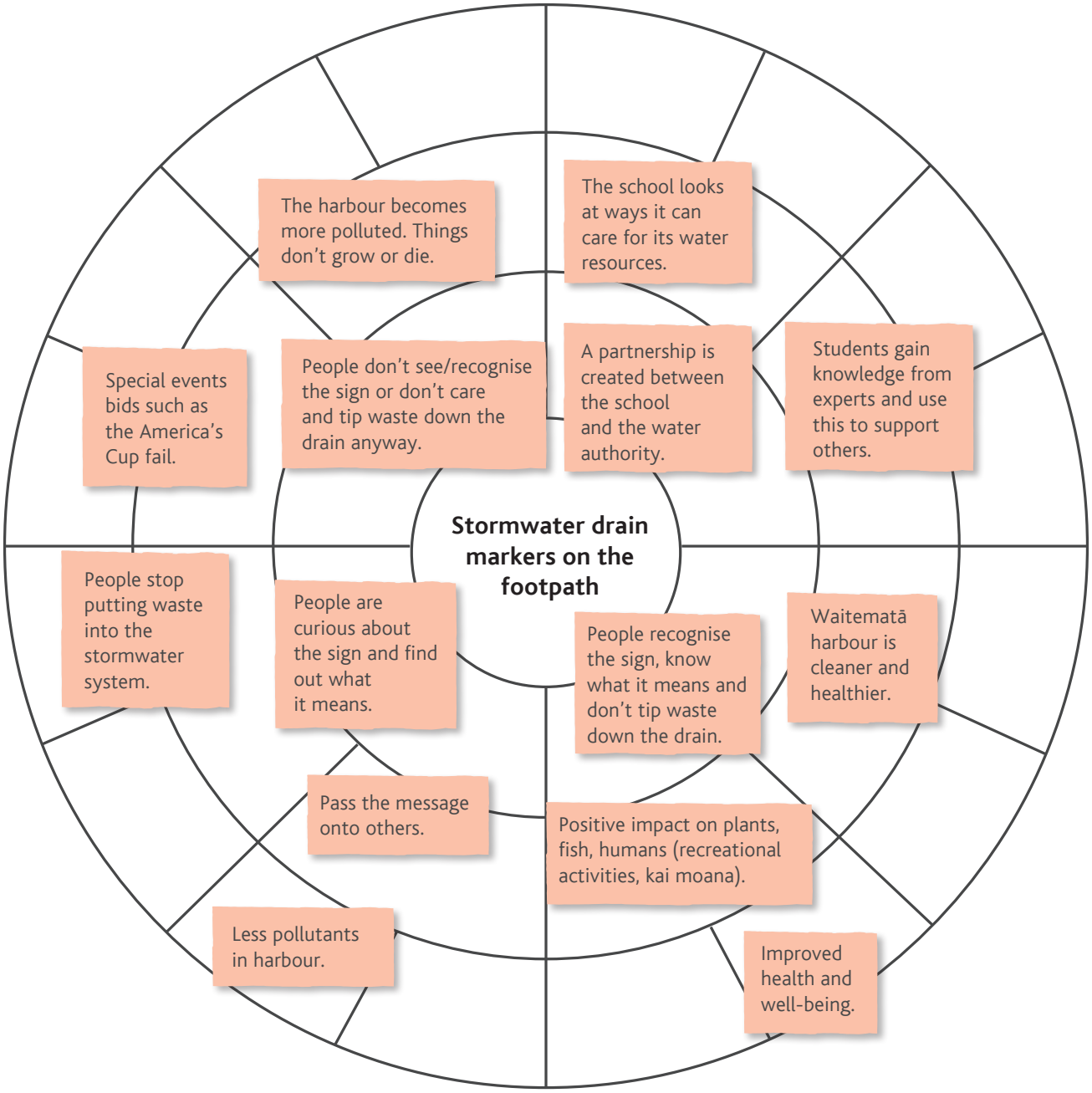
For more information:

efs.tki.org.nz/Curriculum-resources-and-tools/Consequence-Wheel

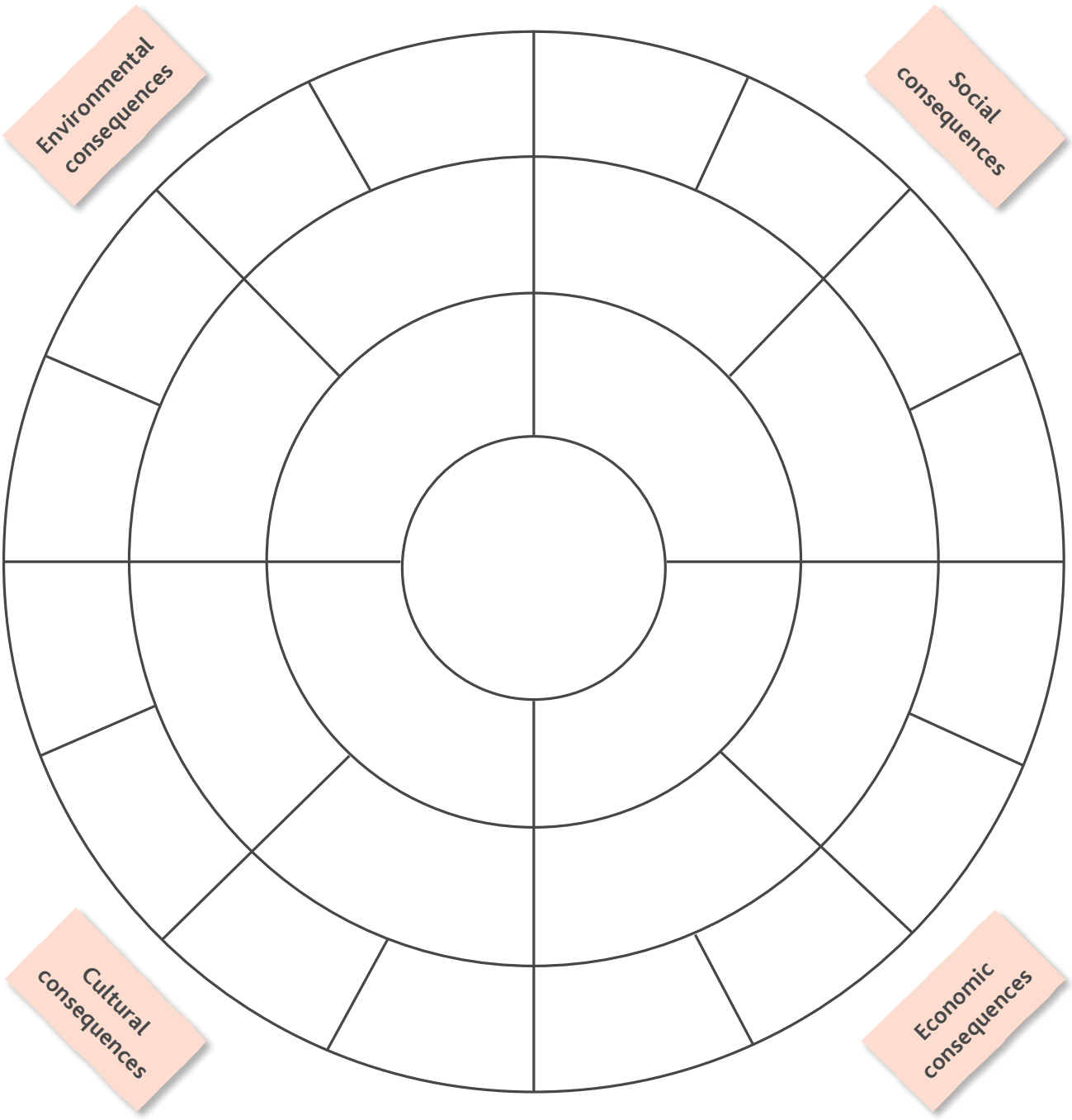
Note: The streams/wetland food web activity can be used here too.

Learning sequence

This consequence wheel was completed by a group of teachers in response to the article 'Blue Fish on the Footpath' by Pat Quinn, School Journal 1992:2.



CONSEQUENCE WHEEL FOR STORMWATER ACTION



BRAINSTORM RESOURCE FOR THE CONSEQUENCE WHEEL

Environmental sustainability

Making sure all forms of life (animals and plants) and their habitats are **looked after**. This will ensure that all ecosystems in both natural and man-made environments will be maintained so that all the **different forms of life can exist together.**

Social sustainability

All **people** are considered **equal** whether they are from different cultures, ages or social groups and they all have the **same rights** to exist and grow in a supportive community within a healthy environment. Resources are distributed fairly.

Cultural sustainability

All cultures are **valued** for their way of living in the world. Communities **respect** different cultures and allow everyone the opportunity to share their attitudes and values and to participate in decision making about their environment.

Economic sustainability

We must consider how we use resources from the land, sea and air, to make money, so we don't run out of resources or destroy the earth now and in the future.

SURFACE TYPES AND THEIR EFFECTS ON THE ENVIRONMENT

Permeable surface

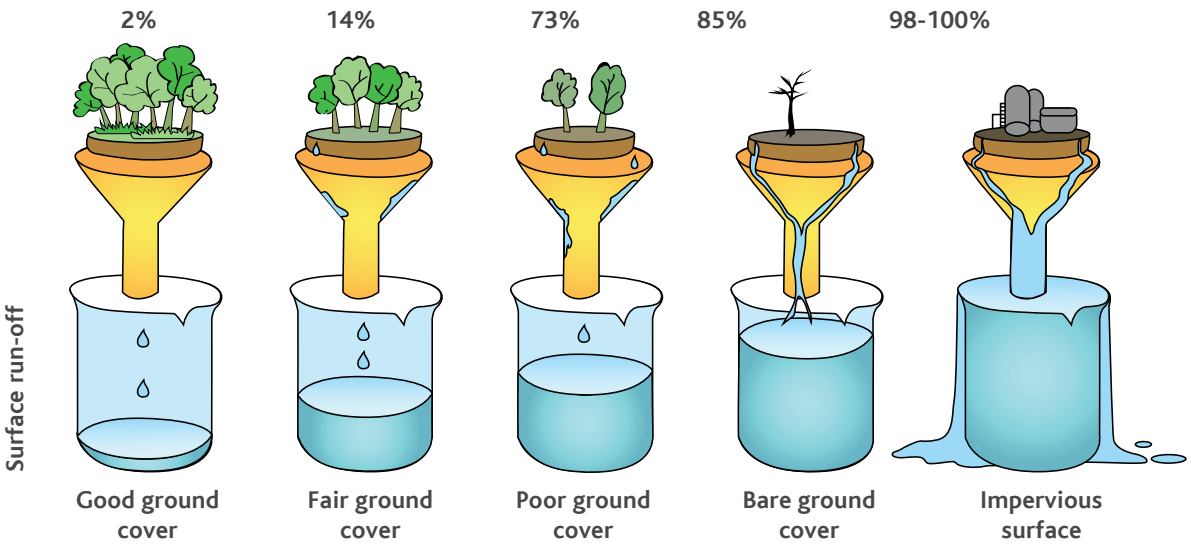
Permeable surfaces allow water to soak in. This water reaches the underground streams (called aquifers) and then travels into rivers below the surface of the water. While it travels it is cleaned and cooled. An example of a permeable surface is bush or farm land with grass and trees.

Impermeable surface

An impermeable surface is any surface that does not allow water to soak through. This includes roads and roofs. This water, called stormwater, travels to the streams or the ocean through stormwater pipes. If the amount of impervious surface in a catchment is 25% or more, it is very difficult to restore the quality of the stream water by shading the stream, planting riparian vegetation or other methods.

Impermeable surfaces can be a biological hazard as they help to transport pollution to stormwater drains. This pollution can include heavy metals, such as zinc attached to sediment particles, some of which come from motor oils and vehicle tyres. This is a problem because then the water carries less dissolved oxygen, which is required by all the animals in the stream.

Stormwater carries dissolved pollutants such as nitrates which degrades our oceans. With more stormwater running off our hard, impermeable surfaces, we are causing a great deal of damage to our ocean environments as well as to the rivers.



Percentage (%) of surface run-off on a variety surfaces

PROJECT TWIN STREAMS CASE STUDY

projecttwinstreams.com

Teacher rationale

This activity is to inspire students to see that actions are possible and the differences that can be made. If at all possible it is strongly advised that students visit a stream where there has been successful restoration and experience the difference in the environment by being in that place. Organise students to take part in a community planting and speak to people who have taken part in the restorations. Many of the action projects on the website are good places to visit or make contact with the action groups.

Student activity

To illustrate the possibilities of taking action use the Project Twin Streams website to give examples of the change that is possible. You may wish to research a more local example. There are also other examples on this website.

PROJECT TWIN STREAMS WORKSHEET

Project Twin Streams is a local project with regional benefits. It works with nature and with people to improve the health of our waterways and harbour.

 projecttwinstreams.com

Look at the picture of the stream on the home page.

1. How would you describe this stream environment in four to five sentences? (Use scientific terms as well as descriptive words).
2. Explain how this environment would impact on the:
   a. native freshwater fish and macroinvertebrates
   b. community
   c. harbour.
3. Thinking of the streams in your own catchment, give a personal response and comparison to the streams mentioned on this website: projecttwinstreams.com/?page_id=15

   Go to the 'where' tab and choose a location from the map.
4. Describe the stream project using the Stormwater Consequence Wheel. Comment on the outcomes for the environment, society, different cultures, and the economy.

   Go to the 'resources' page and look at case studies.
5. Choose one case study and identify two different actions or strategies that were effective. Explain why.
6. Look at the snapshots page and find one example of cultural sustainability and one of economic sustainability. Write brief bullet points to describe each example.

   Go to the 'about' page facts and figures.
7. Comment on three of the statistics given and explain how they contribute to a sustainable future.

TĀMAKI RIVER CASE STUDY INVITED CONTRIBUTION

by Moana Tamaariki-Pohe

From Hauraki Gulf State of Environment Report 2011, page 129, 6.8 Case Study 1

A traditional name for the Tāmaki River is Waimokoia, which refers to 'a place of assembly for mutual protection.' Auckland is traditionally known as Tāmaki Makaurau, meaning 'Tāmaki, desired by many.' Tāmaki has been highly sought after and occupied by many, just as it is in contemporary times.

At the time of the Great Migration, Taikehu of the ancestral Tainui waka was the first to sight the Tāmaki River while standing on the summit of Takarunga (now known as Mount Victoria). Just beyond the river he saw the expansive Manukau Harbour, and thereby discovered the shortest portage between the east and west coast of Te-Ika-a-Māui (the North Island). The waka sailed the Waitematā and into the southern reaches of the Tāmaki River. The great Tainui waka was then beached and dragged two kilometres overland, across the Otahuhu Portage, to be launched into the Manukau Harbour before sailing along the west coast to its final landing place at Kawhia.

The traditions of many other ancestral arrival waka also pass through Tāmaki River, including Matahorua, Aotea, Mataatua, Te Arawa, Takitimu and Tokomaru. The overland crossing provided access to west coast destinations such as Kawhia, Raglan or Taranaki, without the arduous journey around the North Cape. It was of immense strategic importance to Māori, as well as later European travellers. The Tāmaki River marked the boundary between tribal lands, and several notable pā were built along it. Fierce battles for supremacy, of legendary proportions, were fought on and along the river. Many warriors were captured, slain or drowned in the river during the fighting. In more peaceful times, the river served as a major thoroughfare for travel by waka. It was an abundant source of seafood, including fish, cockles, pipi, oysters, scallops and mussels. The surrounding land was filled with kainga (villages) and gardens. The river itself is actually an estuary, with bright-green seagrass meadows, large exposed sandflats and sandstone reef, mudflats and rock platforms, and even an exposure of volcanic ash from the Taupo volcanic zone. It includes extensive shellfish beds and a long sand-shell spit used by hundreds of native wading birds, some of which are endangered. DOC has designated it as an "area of significant conservation value."

What will it take to return the Tāmaki River to its former glory? Would knowing the history make a difference? Would knowing its original state and status help people to see the extent of modern abuse and degradation? What will it take to revitalise the once majestic river?

Fortunately or unfortunately, whichever way you choose to look at it, most of the published information available today pertains to the level of pollution, toxins and other contaminants in the Tāmaki River.

In January 2007 the Auckland Regional Council released a media statement "Aquatic Life Affected in Tāmaki," noting from the 2005 survey, that the Tāmaki River is amongst the worst in the region, with particularly high levels of zinc. Zinc enters the estuary from sources such as galvanised roofing, killing small invertebrates such as cockles. As these creatures are at the bottom of the food chain, they in turn affect larger species such as fish and seabirds.

Formerly common species of shellfish have been poisoned by an anti-fouling paint used on marine vessels. The paint has now been banned; nonetheless, its detrimental effects on the ecosystem continue: many species of shelled molluscs are smaller in both size and number. Exotic species introduced by international shipping have caused further problems. The introduced Asian date mussel, for example, creates vast carpet-like beds that exacerbate the build-up of mud and siltation. *Auckland Council's State of the Environment Report 2011, page 129.*

The area surrounding the estuary has become heavily urbanised. It includes densely populated residential areas, motorways, factories and an abattoir. Building developments have caused freshwater run-off, silt and sewage overflows enter the estuary; most of the land in the area discharges stormwater, which is totally untreated into the estuary. Formerly sandy beaches have been buried in mud. Salinity levels have dropped, decreasing biodiversity and straining native species that thrive in salty water. From the banks of the estuary, the pollution is obvious. There is broken glass, debris, factory rubbish and run-off, and household refuse floating in the bad-smelling water (Figure 58).

Figure 58: abandoned shopping carts and other refuse accumulating on the shore in the upper parts of Tāmaki River.

Nonetheless, people still fish from the banks and local waka ama teams continue to train here. Paddlers complain of infected wounds after being cut on hidden debris in the murky, silty water. Bouts of conjunctivitis are common after being splashed in the eyes. Some paddlers are careful to wash exposed skin with clean water and disinfectant immediately after sports training, to minimise the health risks caused by contact with the polluted water.

Restoring the Tāmaki River will not be easy, and will require deeper understanding and collaboration from all parties. But as the American environmentalist Aldo Leopold said, "We grieve only for what we know."

In order to attain support for clean-up efforts, we must strengthen our knowledge of the ecological importance and cultural significance of the estuary. A deeper understanding of its history and appreciation for its great potential will certainly strengthen the urgency to work collaboratively to establish rāhui and return the river to a clean, thriving state.

aucklandcouncil.govt.nz/EN/AboutCouncil/representativesbodies/haurakigulfforum/Documents/hgfstateoftheenvreport2011.pdf

Questions:

1. List three thoughts or feelings that you have from reading this case study.
2. How is the state of the Tāmaki River related to our stream study?
3. How does stormwater run-off affect the river?
4. What human activities impact on the stormwater run-off that gets to the river?
5. What effect will the degradation of this river have on the local environment and the Hauraki Gulf, on the local people and local economy?
6. This river has special significance for Māori. How will the state of the river today affect mana whenua?

Glossary:

Rāhui is a restriction that sets aside an area and bans the harvesting of resources. For example, a lake or a forest might be temporarily off-limits so the fish, birds or plants can be restored.

Mana whenua means the authority of a tribe over land. It included rights not just to the land, but also the beds of lakes, rivers and the sea.

teara.govt.nz

SECONDARY SCHOOL STORMWATER NCEA RESOURCES

SUPPORT MATERIAL

AS 90811: 'WHAT'S HAPPENING?' STUDENT FIELD TRIP WORKSHEET 1

EfS 2.2 Explain how human activity in a biophysical environment has consequences for a sustainable future.

Name: _____

Date: ____/____/____

Name of stream: _____

Meaning/history of name, if available: _____

- **Human activity** has an effect on stormwater.
- Stormwater changes the stream's biophysical **environment.**
- These changes affect a **sustainable future** in terms of the environment, society, economy and culture.

Explaining the main idea – stormwater

Words	Definitions I need	Activities
Catchment		Use a map to: • describe the location and size of the catchment • ocate on the map the roads which (roughly) follow the boundaries of the catchment • ocate on the map the features near your stream, e.g. school, shops, industry • locate and label the harbour and/or estuary where the stream ends • locate any tributaries. Write the title 'Key features of catchment' above your map.
Stormwater		
Impervious		
Pervious		
Run-off		
Flow		
Channel		
Harbour		
Estuary		
Substrate		
Tributary		
Stagnant		
Riparian margins		
Sewage overflow		

Describing the physical environment of the stream.

- **Draw** a bird's eye view of the stream. Include a scale.
- **Label** the stormwater outlets, banks, flow direction and any other features.
- **Describe** the banks, water, bottom of stream, plants and any litter.

Bird's eye diagram of: _____

Explaining how stormwater picks up pollution which then affects the culture of the local community

Words	Definitions I need	Activities
Habitat		Explain how stormwater affects the stream habitat in the catchment. Use the words from the list provided.
Pollution		
Catch pits		
Hydrocarbons		
Cadmium		
Zinc		
Copper		
Heavy metals		
Sediments		
Sampling		
Accumulate		
Pathogens		
Outlet		
Shellfish		
Mud banks		
Mangroves		

Words	Definitions I need	Activities
Mahinga kai		Add to this flow diagram that begins with some human activities that affect stormwater and ends with the loss of 'mahinga kai.' ('Mahinga kai' refers to indigenous freshwater species that have traditionally been used as food, tools, etc.).
Urbanisation		
Construction		
Eroding		
Flood		
Marine		
Explain how stormwater can affect the marine environment.		

AS 90811: 'WHAT'S HAPPENING?'
STUDENT FIELD TRIP WORKSHEET 2

Name: _____ Date: ____/____/_____

Words	Definitions I need	Activities
Macroinvertebrates		Add words or phrases below to the timeline to describe the water quality of a typical stream. Include: forest streams, urban streams, farming, urban growth, tolerant macroinvertebrates, sensitive macroinvertebrates, high biodiversity, low biodiversity. Timeline:
Habitat		
Urban		
Adaptation		
Agriculture		
Tolerant		
Sensitive		
Biodiversity		
Species		

Words	Definitions I need	Activities
Food webs in the stream community		In your group, draw a simple stream food web using the species you have identified and other resources. Bracket the scientific names and use arrows to show the energy flow from producers to top carnivores. Use the foodweb cards provided to help you.
Producers		
Herbivores		
Carnivores		
Decomposers		
Bacteria		
Fungi		
Algae		
Snails		
Shrimps		
Mosquito larvae		
Pest fish		
Interdependence		
Exotic		

Explain how the parts of the food web are connected and depend on each other (interdependence). Give examples, using the species names.

Explaining the main idea: how our stormwater changes the biophysical nature of the stream

Words	Definitions I need	Construct a table of the data you collected at the stream
Temperature		
Flow rate		
pH		
Nitrates		
Phosphates		
Turbidity		
Oxygen		
Substrate		
Heavy metals		
Rainfall		
Contaminants		
Nutrients		
Eutrophication		

Explain the health of the stream based on the results you have collected:

Name three of the measurements you have collected and explain how they have been changed by stormwater, using the diagram below:

How water quality	is affected	by stormwater
For example, temperature of the stream increases.		Stormwater comes off heated roads and roofs in summer.

Source: Thanks to Julia Tuineau.

AS 90811: STUDENT CHECKLIST FOR ASSESSMENT

EfS 2.2 Explain how human activity in a biophysical environment has consequences for a sustainable future

	Explain what sustainability means:	Check
Sustainability	Give a clear and comprehensive definition of sustainability using these four aspects of sustainability (environment, society, economy, culture).	
	Describe the stream ecosystem.	
	Explain how people are part of ecosystems and depend on them (interdependence).	
	Explain how people should take responsibility for their impact on nature.	
	Describe a sustainable future in relation to stormwater.	
	Discuss personal and social responsibility.	

	Describe the biophysical environment you are studying:	Check
Biophysical environment	On a map be able to show and identify the main features. This includes an outline of the borders of the biophysical environment, its size, location and other factors.	
	Describe the biophysical environment you are studying using annotated diagrams, flow charts or diagrams. These may include:	
	• a description of a stream or waterway including temperature, climate, light, shelter and the stream profile	
	• drawing of the stream and the banks showing the direction and strength of the current, the makeup of substrate (stream bottom) as well as plants on the banks, indicating their size	
	• any in-stream plants or animals that are found	
	• the location of the stream or waterway.	

	Describe the biological nature of the waterway using annotated diagrams, flow charts or pictures. These may include:	Check
Ecology	• listing the scientific names of some key species	
	• showing the main producers	
	• showing the decomposers	
	• showing the main consumers	
	• drawing the stream food web using species names of key organisms	
	• indicating the role of the producers in the waterway.	
	Explain the terms species diversity and abundance in relationship to the waterway you are studying.	
	Explain interdependence (relationships) in terms of this ecosystem.	

	Describe the physical nature of the stream using annotated diagrams, flow charts, graphs or tables. These will include:	Check
Physical system	• the water quality	
	• the water flow.	
	Identify the main threats to water quality.	
	Describe the causes of sedimentation, if applicable.	
	Describe the effect of sedimentation on water quality.	
	Describe any erosion.	

	Explain impacts of human activity on stormwater:	Check
Human activity	Explain the impact of stormwater on the stream environment and water quality.	
	Explain how stormwater has affected the biodiversity of the waterway visited for example:	
	• number of species	
	• types of species	
	• food web structure.	

	Explain how stormwater could impact the future. This may include an explanation of:	Check
Consequences for a sustainable future	• the possible impact on the wider marine environment in the harbours	
	• how stormwater can affect the environment and ecosytems	
	• how stormwater affects society	
	• how stormwater affects different cultures in the local community, including specific tangata whenua issues	
	• the impact of stormwater on the economy of the region.	

Source: Thanks to Antje Kleinmans.

AS 90811: STORMWATER CONSEQUENCE MATRIX

Summary sheet – physical changes

Name physical changes because of stormwater	Drawing	Describe what has happened	How or why has this affected the stream?	So what? What does this mean for the future? (Include aspects of sustainability)
1.				
2.				
3.				

Summary sheet – ecological changes

Name ecological changes because of stormwater	Drawing	Describe what has happened	How or why has this affected the stream?	So what? What does this mean for the future? (Include aspects of sustainability)
1.				
2.				
3.				

AS 90832: STUDENT ACTIVITY

Future focus planning

EfS 3.5 Develop a strategy for an organisation that will contribute to a sustainable future.

The table on the next few pages was created at a hui organised by the World Wildlife Fund (WWF) following the release of the Hauraki Gulf Forum Report 2011. The table that follows provides an example of collaborative thinking about issues and solutions for the Hauraki Gulf Marine Park.

Students can work in groups to explore future thinking and use criteria to make decisions. They can then use the model matrix template at the end of this document when developing ideas around a strategy with their organisations.

Students could work in groups of three and work with the information for one threat (chosen from the five threats – stormwater, sedimentation, nitrification, plastic debris and overfishing).
Each group would then complete the worksheet on the following page. The groups could share their understanding with the other groups in the class to look at possible solutions, as well as to reflect on the process of using decision making matrices.

AS 90832: STUDENT ACTIVITY

Future focus planning

EfS 3.5 Develop a strategy for an organisation that will contribute to a sustainable future.

Purpose: To explore solutions to issues in Auckland's waterways and use a decision matrix.

Student instructions

- In groups of three read through the matrix about one threat for the Hauraki Gulf Marine Park.
- Write a title on the worksheet based on the threat.
- Work together to build understanding. Draw a sketch of the present and the future for the Hauraki Gulf Marine Park.
- Use the actions outlined to trial using a matrix to decide which action would have the best outcome.
- Criteria have been suggested based on successful environmental strategies. Add your own criteria in the last column, e.g. time frame, long-term cost/benefit.
- As a group, decide which action you would choose first.
- In your group choose one key message and plan how you would get the message across to the public, e.g. poster, video, song.

Hauraki Gulf Marine Park (HGMP) decision matrix for action

Threat	Source of threat	Desired outcome	Action required for desired outcome	What's currently happening? Who's working on it?	Action still required	Key message to address required action
Stormwater contaminants	Urban, e.g. road and roof run-off. Industrial.	No contaminants entering HGMP via stormwater, i.e. a return to natural stormwater runoff systems. (Note: This has been achieved successfully, e.g. Whaingaroa/ Raglan Harbour). Increased ecosystem services/functions.	'Only drain rain' initiatives. Polluter pays. Consumer knowledge, i.e. better consumer choice, e.g. organics. Alternatives – information on fertiliser substitutes. Compliance enforcement. Action through Auckland Spatial Plan with an emphasis on prescriptive plans. Maintain integrity and reinstate natural water barriers, e.g. more Waiataruas.	Clean Streams Accord (but low uptake due to voluntary nature). Adopt a stream. Stream fencing by farmers.	More restoration and protection projects. Riparian planting. Linking of sedimentation to HGMP. Show links with clear definitions. Better council decisions on development. Transport design changes. Better urban design to reduce travel demand.	Only rain goes down the drain. Linkage of heavy metals and other contaminants in HGMP to cars, roofs, roads. Sediment kills cockles. Get involved in restoration projects. Slow it down/slow the flow (need understanding that the speed of flushing makes a difference). Explain what is meant by 'sedimentation'.

Threat	Source of threat	Desired outcome	Action required for desired outcome	What's currently happening? Who's working on it?	Action still required	Key message to address required action
Stormwater contaminants			Protection and restoration of waterways, e.g. via riparian planting.			Connection of physical changes in the HGMP with nitrification, i.e. the reason why you can't swim. De-normalisation of closed beaches. The water should be 100% safe (within natural limits) for swimming and taking kaimoana. Urgency of required action.
Sedimentation	Affected by land use – clearance (sometimes historical), agriculture, subdivision, urban sprawl, coastal development. Extreme weather, e.g. climate change.	Cleaner, clearer water. Functioning ecosystem. Key species restored. Less sedimentation. Decreased fine sediment. Improved urban planning.	Action through the Auckland Spatial Plan with an emphasis on prescriptive plans. Maintain integrity and reinstate natural water barriers, e.g. more Waiataruas.	Various restoration projects, many catchment based, e.g. Project Twin Streams.	More restoration and protection projects, including riparian planting. Linking of sedimentation to HGMP, showing links with clear definitions.	Sediment kills cockles. Get involved in restoration projects. Slow it down/slow the flow. (Need understanding that the speed of flushing makes a difference).

Threat	Source of threat	Desired outcome	Action required for desired outcome	What's currently happening? Who's working on it?	Action still required	Key message to address required action
Sedimentation			Protection and restoration of waterways, e.g. via riparian planting.		Better decisions on development.	Explain what is meant by sedimentation.
Nitrification	Agriculture (i.e. fertilisers). Aquaculture, i.e. fish farms. Forestry. 'Dogs, stock and ducks', i.e. poo.	No more algal blooms due to nitrogen (N) pollution. Reduce N entering the HGMP. Substitution to natural fertilisers and 'closed' systems. Compliance.	Polluter pays. Consumer knowledge, i.e. better consumer choice (e.g. organics). Suggest alternatives, e.g. information on fertiliser substitutes. Compliance enforcement.	'Clean Streams' accord (but low uptake due to voluntary nature). Adopt a stream. Fencing by farmers.	More restoration and protection projects, including riparian planting. Linking of sedimentation to HGMP, show links, with clear definitions. Better decisions on development.	Connection of physical changes in the HGMP with nitrification, i.e. the reason why you can't swim. De-normalisation of closed beaches. The water should be 100% safe (within natural limits) for swimming and harvesting kaimoana. Urgency of required action.

Threat	Source of threat	Desired outcome	Action required for desired outcome	What's currently happening? Who's working on it?	Action still required	Key message to address required action
Plastic debris	80% of debris in HG is from land-based sources, 20% marine-based. Then breaks down into three areas: 1. Industry (material design, i.e. packaging, and cost of lifecycle). 2. Household (users of products). 3. Community, i.e. sorting, collection, disposal.	No more marine debris ending up in the HG food chain. Cradle to cradle. Stewardship.	Prevention. Clean up. Find out 'What's currently out there.' Cradle to cradle. Stewardship.	Beach clean ups (but has this normalised the idea that there is marine debris?)	Prevention, i.e. consumption patterns. Cradle to cradle. Stewardship. Suggestions of specific actions: take plastic back to source, i.e. supermarkets legislation, e.g. provision of covered rubbish bins encourage less use of disposables, e.g. consumer/producer awards.	80% is from the land i.e. you. Buy less packaging. Look at how much packaging you are buying. Connection of product use to the environment. Use data specific to the HG. Is there anything in the Ministry for the Environment's 'State of the Environment' report? Map of 'hot spots' for marine debris.

Threat	Source of threat	Desired outcome	Action required for desired outcome	What's currently happening? Who's working on it?	Action still required	Key message to address required action
Fishing pressure	Management, i.e. Quota Management System (QMS) has a single-species focus with a Total Allowable Catch set too high. Recreational and commercial impact. Fishing technology (e.g. bottom trawling).	Restoration of functioning ecosystem, leading to increased fish stocks.	QMS (Quota Management, System) changes.	Some lobbying.	Switch to ecosystem-based management system. Ten per cent of HGMP set aside as marine reserve (in line with government's pledge to have 10% of the Exclusive Economic Zone set aside as Marine Protected Areas). Lobby government to have HGMP considered as having special status under the QMS, i.e. to have fishing management aligned with the HGMP vision. Look at upper size limit for each fish caught.	There is a cost in keeping stocks at 20-30% and there is value in abundance. Tell stories from older generations of what the 'normal' fish stocks and abundance was for HGMP. Good fisheries management equals abundance. What's the gain compared to what you're giving up? HGMP is in a profoundly altered state with respect to marine biodiversity.

Worksheet using the matrix on the previous pages

Title: _____

Identify any terms or statements that you have not heard of. Discuss in your group and follow up with any research:

Share ideas and explain what the threat you are investigating is:

Draw a sketch to show the relationships between the source of the threat and the sea. Annotate or add sketches to illustrate 'what's currently happening':

Draw another sketch showing the actions still required:

Look at all the actions required now/in the future and fill out the decision matrix below:

Actions	Does the action have a permanent or long lasting benefit?	Does the action include lots of people doing something small?	Will the action impact on society, cultures and/or the economy? Describe how	Choose a success criterion

Which action would you choose? _____

Plan a **social marketing strategy** to get one key message out to the public. Write it below:

Model matrix template – to use when working with your organisation

Threat	Source of threat	Desired outcome	Action required for desired outcome	What's currently happening? Who's working on it?	Action still required	Key message to address required action

Auckland Council
Te Kaunihera o Tāmaki Makaurau