Stage 4 Science – Separating Mixtures Chemical World
Teacher lesson plan – Sedimentation & decanting

Sydney WATER

Key inquiry questions How can we use sedimentation and decanting to separate out a mixture (wastewater) to help protect public health and the environment?	Time: 2 x 45-60 min
Syllabus Outcomes SC4-1VA, appreciates the importance of science in their lives and the role of scientific inquiry in **increasing understanding of the world around them** SC4-13ES-explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about **resource use and management** SC4-17CW-explains how scientific understanding of, and discoveries about the properties of elements, compounds and **mixtures relate to their uses in everyday life**	**Working scientifically skills** SC4-5WS - collaboratively and individually produces a plan to investigate questions and problems SC4-6WS - follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually SC4-7WS - processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns, and relationships, and draw conclusions
Syllabus Content CW3 Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques. a. describe the **importance of water as a solvent in daily life,** industries, and **the environment** c. relate a range of techniques used to separate the components of some common mixtures to the physical principles involved **decanting** d. investigate the application of a physical separation technique used in everyday situations or industrial processes - **water filtering, sorting waste materials** e. research how people in different occupations use understanding and skills from across the disciplines of Science in carrying out separation techniques	**Sydney Water aim for activity** • Our core objectives are to protect the environment and protect public health. Every day we provide clean safe drinking water and treat your wastewater. • In this lesson, we'll investigate how we use sedimentation and decanting as one of the steps in wastewater treatment. • This practical investigation will show how we use working scientifically skills. • We'll explore the importance in carrying out separation techniques in a real-life application. The lesson plan can be used to help students to think about: 1. How we treat wastewater to a high quality to release back into the environment or for re-use as recycled water. 2. How we recover resources like their organic matter to make biosolids a sustainable fertiliser.

Teaching and learning	**Resources**
Lesson 1: Introduction to wastewater **1. Setting the scene** **Q.** Have you ever wondered what happens to water after you've used it inside the house? **A.** Probably not! Water is an excellent solvent which means it dissolves and carries things. Once you've used the clean, safe drinking water – it has become a mixture we now call wastewater and	**Sydney Water resources** Wastewater treatment Water recycling

goes down the drain. Wastewater is 99% water and the remaining 1% is made up of things you've added to the water.

Did you know? One of Sydney Waters core objective is to protect the environment. We do this in a range of ways including wastewater treatment. See the Wastewater treatment webpage for more information.

Activity: Imagine, you are a group of engineers and scientists at Sydney Water. You need separate water and organic waste at a water recycling plant. You will first make a wastewater sample that contains a higher level of waste, to ensure your separation techniques work even in extreme conditions. By the understanding the science of your mixture and separation techniques. You can design processes in plants that:

- work all the time (reliable) and be repeated easily (replicable)
- work well under a range of conditions and isn't expensive to run (effective and efficient)
- allow you to separate the water to recycle and recycle organic waste
- be clean and safe, a process that won't harm others or the environment which will be constantly monitored.

2. Making a wastewater sample

Activity: So, what's in the one percent of wastewater? Use this diagram and annotate some of the things, that you put down the drain in each room. The image can be found on the Wastewater treatment webpage.

Activity: Conduct a risk assessment and make a mock wastewater sample in a large clear container. You can find the instructions on our High school webpage.

Risk	Rating	Control
Cut/Abrasion	M	Elimination – use plastic containers Administration – be careful with sharps
Poison	L	Administration – follow instructions on packages, don't consume the substances

Urban water management

Wastewater network

Solids recycling

3. Water is valuable, waste can be too **Q.** So, from here where does it go? What happens to the water and waste in wastewater? **A.** We treat the wastewater at a wastewater treatment or water recycling plant. The wastewater is separated for: • re-use as recycled water - for things like flushing toilets, cleaning, parks, and gardens. • environmental flows - we release treated water to keep rivers and creeks healthy. • organic waste - food, fats, oils, and grease, toilet paper and your poo are collected and gets turned into a safe fertiliser called biosolids. If you think that's gross…what is compost and manure made from! • inorganic waste - rubbish like plastic, wipes and things that shouldn't go down the drain are removed and sent to resource recovery centres where they are sorted and often sent to landfill See our Wastewater treatment and Water recycling webpages for more information. **Did you know?** We use water that comes from the natural water cycle and it eventually gets released back to the environment. See our Urban water management and Natural water cycle page for more information.	
Lesson 2: Body - Separating the mock wastewater sample to protect the environment You will need for each group: • 3 x containers to place the rubbish (inorganic waste), biosolid (organic waste), and wastewater when straining • 1 x Strainer, slotted spoon, and/or small tongs to remove rubbish • 1 x Spoon or dropper pipette to remove oil • 1 x Spoon or silicon spatula to remove sediment **Q.** Looking at your wastewater sample from the previous lesson. What do you think is the first separation technique should be? **A.** Get rid of large solids – mostly rubbish like wipes and plastics. These interfere with other processes as they clog machines, so must go first. **Activity 1:** Strain or remove by hand unwanted items like wipes, floss, and any plastics – place in the beaker or bin. Set aside you wastewater sample, continue with activities – sedimentation will occur during this time. **Activity 2:** Use the *How we turn wastewater into recycled water video and How wastewater is treated and recycled* video to show them primary treatment and our sedimentation tanks. Were their predictions right, did we use the technique they thought? **Activity 3:** Students are to: 1. Write or share their definition of sedimentation and decanting. 2. Look at their wastewater sample that they left aside. Draw an annotated diagram of the container and liquid. They should note each layer such as the oil (scum), sediment (sludge) and wastewater. 3. Students can gently scrape with a spoon or use pipette to remove the top layer of scum into a 'biosolid' container. They can then decant the water in a 'wastewater' container. Scrape or pour the remaining sludge into the 'biosolid' container.	**Sydney Water resources** How we turn wastewater into recycled water video How wastewater is treated and recycled video Solids recycling

4. After separating, put the rubbish in the bin, pour the water on plants or hold onto the sample in the fridge for a filtration activity in another lesson (see extension options). Organic waste like oil and food scraps can go in the compost as it will degrade, alternatively wipe down and place in the bin. **Did you know?** Transforming our organic waste to biosolid fertiliser reduces the need for chemical fertilisers and can be used to create renewable energy helping us be more sustainable. See our Solids recycling webpage for more information.	
Assessment Thinking as a Sydney Water scientist and engineer. **Q.** Why did we use sedimentation and decanting? **A.** It's: Reliable, replicable, effective, efficient, safe and allows us to separate and recycle organic waste from the water. Ticking all the boxes for Sydney Water scientists and engineers. **Q.** Could you predict what would happen without this technique? **A.** We wouldn't remove the organic waste (scum and sludge), and this can cause problems downstream such as block the filter. Worse the poo could end up our waterways, yuck! **Q.** What actions at home can you take to make your wastewater easier to treat at the plant? **A.** Somethings aren't meant to go into wastewater or in water at all! Rubbish like wipes, plastics should go in the bin, food scraps, oil and grease should either go into the bin or composted. These items can block pipes and fatbergs leading to overflows - where wastewater comes back up and out of pipes!! These items also make it more difficult to recycle water and waste. See our Wastewater treatment and Solids recycling webpages for more information.	**Sydney Water resources** Wastewater treatment Solids recycling
Extension We have a range of experiments and lesson ideas you can use to demonstrate separation techniques used at our wastewater and water recycling plants. See our High school webpages for more information. You can also see some of these techniques by either: • Download our other lesson plans and experiments to investigate separation techniques and the application of scientific knowledge used in managing water. • Reading about the techniques on our Penrith Water Recycling Plant webpage.	**Sydney Water Resources** High School Penrith Water Recycling Plant
Conclusion **Evaluation questions** • What is sedimentation and decanting? Why did we use this specific separation technique? • What other separation techniques can you imagine they use in wastewater treatment? • Can you invent a new separation technique to protect the environment? **Reflection Activity** - Students finish these statements 1. I used to think ……(at the start of these lessons) 2. But now I think …….(at the end of these lessons)	**Sydney Water resources** **Find out more** • sydneywater.com.au/education • facebook.com/SydneyWater • instagram.com/sydneywater • twitter.com/SydneyWaterNews