

Rulebook

Game Link:

<https://tabletopia.com/playground/algae-board-game-prototype-jkvt14/play-now>

Survey Link:

<https://forms.gle/gwFTuHjVR6AhKwM97>

Overview:

Working with Wastewater is a 2-4 player educational board game designed for ages 12 and up hosted on Tabletopia. Each player is a wastewater treatment company looking to maximize profits while minimizing the waste produced by treating wastewater. Companies will start with a distinct wastewater treatment facility with different assets. Purchase additional wastewater treatment technologies to build your company. Will you grow low maintenance algae that can feed on organic waste, but requires a high initial cost? You might consider environmentally friendly solar treated wastewater with low upfront costs that treats water slowly. Or do you prefer rapid and efficient chemical reactions at the cost of producing potentially profitable waste products? As you build your treatment facility, you can play action cards inspired by real-life events. Attract investors to your algae treatment facility to increase your income, but beware of pollution that could kill your algae. Expose your competitors for illegally dumping waste and be on the lookout for hackers that might try to sabotage your outdated security system! Engage in 10 rounds of wastewater treatment as you mix and match technologies to keep our waterways clean!

Starting Site

Place your card here

Resource

Treatments

Starting Site

Place your card here

Resource

Treatments

Market

action card

Treatment Site

Waste
:(
Waste

Resource
\$
Resource

Treatment
Treatment

Starting Site

Place your card here

Resource

Treatments

Company Card

Starting Site

Place your card here

Resource

Treatments

Setup:

All players will start with one **company card**, 5 **resource cards**, and 7 **action cards** dealt by the dealer.

The **company card** defines the company and the stats for each player.

The player with the highest resource stat on their company card will go first. In the case of a tie, of the two players, the player with the lower waste stat will go first. The turn will progress clockwise from where the first player is sitting.



- Resource - # : The resource stat determines how many **resource cards** you can draw per turn.
- Action - # : The action stat determines how many **action cards** you can play or swap (putting an action card in your hand in the bottom of the deck and drawing a new one) per turn.
- Treatment - # : The treatment stat determines how many **treatment points** you can acquire per turn.
- Waste - # : The waste stat determines how many **waste tokens** you gain per turn

On subsequent rounds, the player draws x amount of **resource cards** corresponding to their resource stat and can play y amount of **action cards** corresponding to their action stat. The player can also purchase z amount of **treatment plants**. By playing action cards and acquiring treatment cards, the players will strive to achieve the objective of the game.

Turn Progression:

The turn progression will go as follows:

1. The player draws all cards/tokens based on their stats.
2. The player may buy any treatment sites (and receive the benefits from those sites)
3. The player may play or swap their action cards based on their action stat
4. The player draws action cards until they have 7 in their hand
5. The player ends their turn

The Market:

5 treatment sites from the deck will be placed on the market zone. Players can only buy treatment sites that are present in the market. The empty slots on the market as a result from a purchase are only replenished when the player's turn ends. The market can be reset (swap all cards in the market and replace with 5 new treatments) at any time during the player's turn by spending 1 action point.

Cards:

Resource Cards

These cards are the currency used in the game used to purchase treatment plants. All resource cards have the same value of \$1M(million).

Treatment Point Cards

These cards represent the amount of wastewater your company has treated. Each card represents 1 point. Have the most points by the end of the game to win!

Action Cards

Actions cards are cards that can be played to cause an event with the effects described on the card. The effects can either benefit the player who plays the action card or hinder the other players. After playing **action cards** and ending their turn, the player must draw enough **action cards** to maintain 7 action cards in their hand (these cards can only be drawn at the END of your turn).

Example Action Card:



Facility Cards (Treatment sites)

Facility cards represent the treatment plants that you can purchase with **resource cards**. Each treatment card costs 3 resource cards. These cards describe a different wastewater treatment method that causes different effects that can change the player's stats. A player can buy any facility card they please based on how they think it will benefit them. The effects of the facility cards are IMMEDIATE.

EX) If player 1 buys an algae treatment site, they may also discard 1 waste as that is denoted on the card

Example Treatment Card:



Waste Cards

Waste cards represent the waste produced by the player's wastewater treatment facilities. Each waste card will deduct from their score at the end of the game. Each waste card can be discarded by spending 1 resource.

EX) if player 1 has 20 treatment cards and 10 waste cards at the end of the game, their final score is 10 (20 treatment - 10 waste)

End of the Game:

After the last player ends their turn on turn 10, each player counts their blue treatment tokens. They will subtract from that total the number of waste tokens they have failed to discard. This number is their final score. The winner is the player with the highest score.

In Game Information:

<https://tabletopia.com/playground/algae-board-game-prototype-ed83jf/play-now>

	Action Cards (description in tabletopia)	Example 1	Source
1	Choose a player to be unable to gain treatment points in their next turn	Outdated cyber security systems allow for a hacker to increase sodium hydroxide levels in the water!	https://abcnews.go.com/US/outdated-computer-system-exploited-florida-water-treatment-plant/story?id=75805550#:~:text=An%20outdated%20version%20of%20Windows,memo%20obtained%20by%20ABC%20News.
2	Give another player 4 waste cards	A large business illegally dumps their waste into the ocean	US EPA O. Learn about Ocean Dumping. US EPA. 2015 Jul 10 [accessed 2020 May 14]. https://www.epa.gov/ocean-dumping/learn-about-ocean-dumping
3	Gain 3 resource	Your treatment plants are recognized for avoiding an accident for ten years.	Crittenden, John C., et al. <i>MWH's Water Treatment: Principles and Design</i> . John Wiley & Sons, 2012.
4	Disable all phosphorus treatment sites for 1 turn	Phosphorus treatment sludge byproduct is harming aquatic	US EPA O. Learn about Ocean Dumping. US EPA.

		wildlife	2015 Jul 10 [accessed 2020 May 14]. https://www.epa.gov/ocean-dumping/learn-about-ocean-dumping
5	Destroy 4 algae treatments of your choice (any player)	A wastewater treatment facility is releasing excessive amounts of mercury, arsenic, cyanide, and other toxic chemicals, causing their algae to die	Matheny K. US Ecology's permit violations anger Detroit neighbors. Detroit Free Press. [accessed 2020 May 14]. https://www.freep.com/story/news/local/michigan/detroit/2016/11/16/usecology-hazardous-waste-detroit-sewer/89963514/
6	Gain 1 resource per algae treatment	Investors are interested in new algae treatments as a way of helping the environment.	Markets, Research and. "Amid the COVID-19 Pandemic, the Global Algae Market Is Forecast to Reach \$1.2 Billion by 2027." <i>GlobeNewswire News Room</i> , 26 Nov. 2020, http://www.globenewswire.com/news-release/2020/11/26/2134773/0/en/Amid-the-COVID-19-Pandemic-the-Global-Algae-Market-is-Forecast-to-Reach-1-2-Billion-by-2027.html .
7	All players cannot gain treatment points until your next turn	After a case study, treated wastewater is found to be contaminated!	Full Evacuation Ordered At Piney Point; Collapse Is "Imminent." Bradenton, FL Patch. 2021 Apr 2 [accessed 2021 Apr 3]. https://patch.com/florida/bradenton/emergency-evacuation-ordered-near-piney-point-public-safety
8	Gain 1 treatment point for each algae treatment you own	Your science team continues to research the efficiency of algae	Amenorfenyo, David Kwame, et al. "Microalgae brewery

		treatment plants	wastewater treatment: potentials, benefits and the challenges." <i>International journal of environmental research and public health</i> 16.11 (2019): 1910.
9	Play up to 2 more cards this turn	Volunteers clean up waste from oceans after an oil spill. The beaches are squeaky clean!!!!	“Volunteers Rush to Clean up Israel’s Beaches, Polluted by Massive Oil Spill.” <i>The Observers - France</i> 24, 25 Feb. 2021, https://observers.france24.com/en/middle-east/20210226-volunteers-clean-up-oil-spill-israel-beaches
10	Block a card’s effect at any time.	New groundbreaking research!	Fatta-Kassinou D, Meric S, Nikolaou A. Pharmaceutical residues in environmental waters and wastewater: current state of knowledge and future research. <i>Analytical and Bioanalytical Chemistry</i> . 2011;399(1):251–275. doi:10.1007/s00216-010-4300-9
11	Gain 2 treatment sites of your choice	The government sponsors new technology to help clean wastewater.	US EPA, OW. “Funding Sources for Small and Rural Wastewater Systems.” <i>US EPA</i> , 7 Jan. 2015, https://www.epa.gov/small-and-rural-wastewater-systems/funding-sources-small-and-rural-wastewater-systems .
12	Discard 3 waste cards	Volunteers from your company clean an oil spill using wastewater treatment tactics	Abidli A, Huang Y, Cherukupally P, Bilton AM, Park CB. Novel separator skimmer for oil spill cleanup and oily wastewater

			<p>treatment: From conceptual system design to the first pilot-scale prototype development. <i>Environmental Technology & Innovation</i>. 2020;18:100598. doi:10.1016/j.eti.2019.100598</p>
13	Limit a player to only playing 1 action card for 1 turn	Damage in wastewater treatment infrastructure plant causes major setbacks	<p>Dumping of Piney Point wastewater into Tampa Bay is temporarily stopped after pipeline leak. <i>Sarasota Herald-Tribune</i>. [accessed 2021 Apr 3]. https://www.heraldtribune.com/story/news/local/manatee/2021/04/01/leak-prompts-temporary-stop-piney-point-wastewater-release-into-tampa-bay-florida/4840188001/</p>
14	Discard 2 action cards from an opponent of your choice	Poor working conditions cause wastewater treatment workers to go on strike	<p>Zigmund D. Wastewater treatment violations result in fines. <i>Juneau Empire</i>. 2021 Mar 23 [accessed 2021 Apr 3]. https://www.juneauempire.com/news/wastewater-treatment-violations-result-in-fines/</p>
15	Discard 5 waste cards	Newly enforced and researched waste management lead to a decrease in byproduct waste	<p>Cargo K. Here's why \$18M in improvements for a wastewater plant is a big deal for Calallen. <i>Corpus Christi Caller-Times</i>. [accessed 2021 Apr 3]. https://www.caller.com/story/news</p>

			/local/2021/03/31/heres-how-18-m-improvements-wastewater-plant-helps-calallen/4812383001/
16	Give a player 5 waste cards for each phosphorus treatment site they have	Phosphorous treatment sludge byproduct is causing eutrophication in lakes!	US Department of Commerce NO and AA. What is eutrophication? [accessed 2021 Apr 3]. https://oceanservice.noaa.gov/facts/eutrophication.html
17	Choose a player to double their waste gained in their next turn.	Puzzling waste byproduct from treatment sites are unable to be broken down	Kuizon K. Evacuations ordered north and south of Piney Point due to “imminent” uncontrolled wastewater release. FOX 13 News. 2021 Apr 2 [accessed 2021 Apr 3]. https://www.fox13news.com/news/manatee-county-commissioners-hold-emergency-meeting-to-discuss-next-steps-at-piney-point
18	Disable all Solar treatments sites for 1 turn.	Faulty heat systems cause solar treatment sites to fail	Strazzabosco A, Kenway SJ, Lant PA. Solar PV adoption in wastewater treatment plants: A review of practice in California. <i>Journal of Environmental Management</i> . 2019;248:109337. doi:10.1016/j.jenvman.2019.109337
19	Copy the effects of the last card played but pay 4 resource	Ocean dumping is increased by companies for their comfort. As a result, the government starts to issue fines for dumping.	Ocean Interfaces & Human Impacts L. Føyn, in Encyclopedia of Ocean

			Sciences (Third Edition), 2001
20	Disable all algae treatment sites for 1 turn	Miscalculations on maintaining algae CO2 levels leads to colony death	US EPA O. Climate Change and Harmful Algal Blooms. US EPA. 2013 Sep 5 [accessed 2021 Apr 3]. https://www.epa.gov/nutrientpollution/climate-change-and-harmful-algal-blooms