

TROUBLED WATERS

A cooperative game of Florida water management challenges

[Companion Website](#)

The game board features a map of Florida divided into five Water Management Districts (WMDs): Northwest Florida, Suwannee and Kissimmee Rivers, Southwest Florida, St. Johns River, and South Florida. Each district is color-coded and contains specific project icons and requirements. To the right, there are several tables and legends.

Seasons	Winter	Spring	Summer	Autumn
Rain	0-2 events	2-4 events	3-6 events	1-3 events
Tide	1-2 events	1-2 events	0-2 events	1-2 events
Hurricane	none	none	0-2 storms	1-2 storms
News	0-2 reports	0-2 reports	0-2 reports	0-2 reports

Water Legend	Northwest	Suwannee & Kissimmee	St. Johns River	Southwest	South
Record Flood Stage	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
Water Flood Stage	Yellow	Yellow	Yellow	Yellow	Yellow
Minor Flood Stage	Orange	Orange	Orange	Orange	Orange
Normal Stage	Green	Green	Green	Green	Green

Balance	2	2	3	2	3
Water District Funding	Northwest	Suwannee & Kissimmee	St. Johns River	Southwest	South
4 Actions	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
3 Actions	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
2 Actions	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
1 Action	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue

Victory Project Checklist:

Location	Any 3 coastal zones (except Naples-Big Cypress, Everglades, Keys)	Any 3 zones (except Naples-Big Cypress, Everglades, Keys)	Any district (requires work in all 4 zones)	Any district (requires work in all 4 zones)	Any 2 coastal zones (except Naples-Big Cypress, Everglades, Keys)
Initial Survey and Planning	1 Survey 1 Engineering-Environmental Report	1 Survey 1 Engineering-Environmental Report	1 Survey 1 Engineering-Environmental Report	1 Survey 1 Engineering-Environmental Report	1 Survey 1 Engineering-Environmental Report
Public Support	2 Public Service Announcements	1 Public Service Announcement	4 Public Service Announcements	4 Public Service Announcements	2 Public Service Announcements
Equipment	3 dredges 3 excavators 3 trucks 3 transport ships	3 excavators 3 trucks 3 pump stations	4 excavators 1 tree per zone (appropriate to zone)	4 excavators 2 trees per zone (appropriate to zone)	2 dredges 2 excavators 2 pump stations 2 transport ships
Final Survey	1 Survey	1 Survey	1 Survey	1 Survey	1 Survey

Victory Projects: while actions by Water Management District leaders in response to seasonal weather and news events will keep players in the game, victory requires completion of 4 multi-step projects in 4 of the Water Management Districts. More than one district can choose to pursue the same project type.

Loss Conditions and Continued Play: If two zones in one district or three zones in any three districts are at record flood stage at the end of a round of four seasons, the game ends in a loss. If there are fewer zones at record flood stages than required for a loss at the end of a year round, the game can continue.

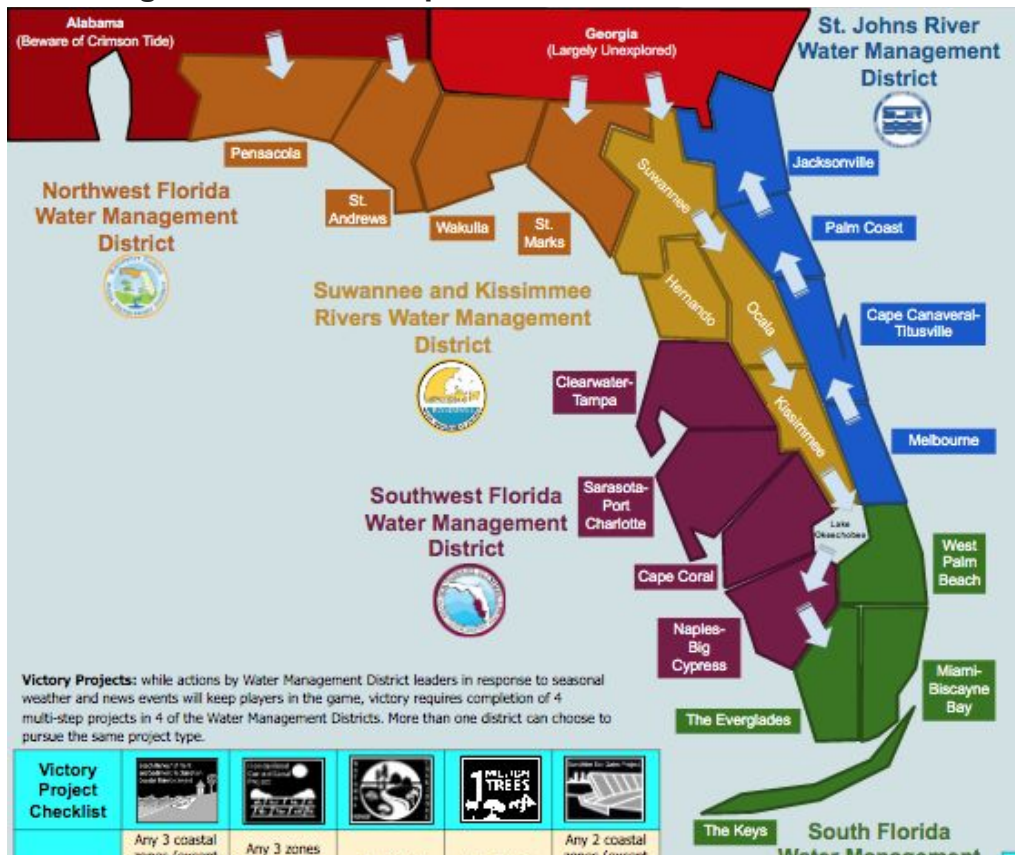
The Game: Players act as the directors of five Florida water management districts to mitigate the seasonal rains, “Spring” supertides, and late summer and early autumn tropical storms by committing funds for services, equipment, and projects. This is a cooperative game, so sharing resources and abilities across district boundaries is encouraged. The game time is measured in year rounds of four seasons each.

Victory Goals: In order to declare victory, four out of five districts must succeed in completing any combination of four long-term project options.

Loss Conditions and Continued Play: If two zones in one district or three zones in any three districts are at record flood stage at the end of a round of four seasons, the game ends in a loss. If there are fewer zones at record flood stages than required for a loss at the end of a year round, the game can continue.

TROUBLED WATERS

The Water Management District Map



[Game board in Google Drawing format](#)

Includes Zones: Pensacola, St. Andrews, Wakulla, and St. Marks.

Mission: Protect, maintain, and improve flood protection and water quality across the panhandle. Specializes in springs restoration, coastal protection, and urban infrastructure upgrades.

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Includes Zones:
Suwannee,
Hernando, Ocala,
and Kissimmee.

Mission: Protect, maintain, and improve flood protection and water quality in the south-flowing Suwannee and Kissimmee watershed corridors. The District specializes in river management and rural and farmland infrastructure upgrades.



Includes Zones:
Clearwater-Tampa
, Sarasota-Port
Charlotte, Cape
Coral, and
Naples-Big
Cypress.

Mission: Protect, maintain, and improve flood protection and water quality along the Gulf of Mexico. The District specializes in coastal management and bald cypress swamp ecosystem preservation.

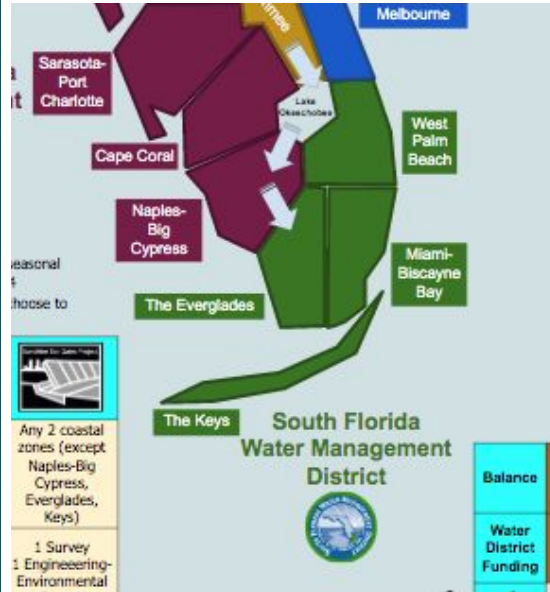


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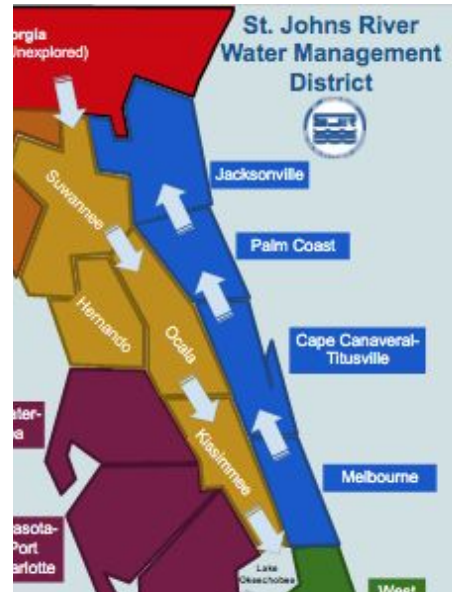
Includes Zones:
West Palm Beach, Miami-Biscayne Bay, the Everglades, and the Keys.

Mission: Protect, maintain, and improve flood protection and water quality in a wide variety of habitats. The District balances dense urban infrastructure, periodic Spring tide flooding, coral island preservation in the Keys, and the unique broad freshwater-marine estuary ecosystem of the Everglades.



Includes Zones:
Jacksonville, Palm Coast, Cape Canaveral-Titusville, and Melbourne.

Mission: Protect, maintain, and improve flood protection and water quality in the north-flowing St. Johns River watershed corridor and the beach margins of the eastern coast. The District specializes in river management, beach preservation, and dense urban infrastructure.



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Flood Level Stages: Each water management district is color-coded, with zones shaded according to the present flood level stage.

Water Legend	Northwest	Suwannee & Kissimmee	St. Johns River	Southwest	South
Record Flood Stage					
Major Flood Stage					
Minor Flood Stage					
Normal Stage					

Change stages of zones by selecting the zone with the pointer and using the "bucket" tool to select the shade.

Normal Stage

- Rivers: the water surface is below bank tops; standing water is limited to small areas of parkland or marshland.
- Coastlines: cycle of tides follows predictable inundation of and retreat from low-lying beach areas.

Minor Flood Stage

- Rivers: slightly above tops of riverbanks. Roadways may be covered with water, lawns may be inundated and water may seep into spaces under building foundations.
- Coastlines: water seeps or channels through the natural dunes. Overwash may cover shoreline roads. Temporary beach structures such as lifeguard stations, gift kiosks, and concession stands may be damaged.

Major Flood Stage

- Rivers: inundation of buildings usually begins. Roads are likely to be closed and some areas cut off. Evacuations may be necessary.
- Coastlines: Water overtops the natural dune and floods shoreline roadways and residential or commercial areas. High surf may pound oceanside structures like piers, boardwalks, docks, seawalls, and Beach houses and resorts.

Record Flood Stage

- Rivers: life-threatening flooding is usually expected at this stage. Low-lying areas are completely inundated. Structures may be completely submerged. Large-scale evacuations and months- or years-long recovery organized.
- Coastlines: Powerful water surges and waves action severely damages homes and businesses. Impacts may be felt well inland and cause millions of dollars in damage, requiring large-scale evacuations and months- or years-long recovery programs.

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Seasonal Conditions: The leaders of the Water Management Districts can plan ahead effectively if they know the likelihood of heavy rains, Spring tides, and tropical storms that can cause flooding.



Seasons	Winter	Spring	Summer	Autumn
Rain	0-2 events	2-4 events	3-6 events	1-3 events
Tide	1-2 events	1-2 events	0-2 events	1-2 spring
Hurricane	none	none	0-2 storms	1-2 storms
News	0-2 reports	0-2 reports	0-2 reports	0-2 reports



Rain: Rain event cards raise the flood level of **one zone one level**. The leaders of the Water Management Districts can place **storm drains, pump stations, or tree plantings** to mitigate the effects of rain.



Spring Tides: Tide event cards raise the flood level of **two adjacent coastal zones by one level**. During full or new moons, when the Earth, Sun, and Moon are nearly in alignment—tidal ranges are more extreme. These “spring tides” can occur 6-8 times a year in any season. **Storm drains, pump stations, sea walls, and palm or mangrove tree plantings** mitigate the effects of tides.



Tropical Storms/Hurricanes: Storm event cards raise the flood level of **three adjacent coastal zones by one level**. Tropical cyclones in the Atlantic are formed by warm, moist air systems over water meeting cooler high pressure air streams at higher altitudes. The Atlantic hurricane season runs from June 1st through November 30th, the summer and autumn seasons of the game. **Storm drains, pump stations, sea walls, and tree plantings** mitigate the effects of storms.

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The Evening News: The leaders of the Water Management Districts are called on from time to time to respond to **events impacting equipment, supplies, revenue, budget, and public goodwill.** Each event will be specific to a **single district.** News events are equally likely throughout the year, with 0-2 events in a season for a total of 4-to-6 events expected per year. News events are *more likely* when *fewer* rain, tide, or storm events occur.

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NewsStoryList

- 1 District Budget Shortage (-1 Action/temporary)
- 2 Equipment Failure (-1 Equipment)
- 3 Labor Strike (-1 Action/temporary)
- 4 Public Apathy (no change/goodwill)
- 5 Vocal Opposition (-1 goodwill)
- 6 Government Indecision (no budget change/season)
- 7 Supply Shortage (0 new production)
- 8 Inspection Failure (1 Station idle)
- 9 Critical Editorial (PSA no effect/season)
- 10 Grassroots Resistance (neutralizes PSA)
- 11 Property Legal Suit (0 new construction)

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length 15

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Public Goodwill: How well the public understands a past, ongoing, or potential water management crisis or issue will impact the amount of public support for--






- the number and effectiveness of player actions in a season, and
- the likelihood of success for multi-step projects.

	<p>Community Partnership: The community trusts and supports the Water Management District leadership. Player-selected victory goal projects can proceed with fewer Public Service Announcements.</p>
	<p>Public Support: The community supports the Water Management District leadership. Player-selected victory goal projects can proceed with the balanced amount of Public Service Announcements.</p>
	<p>Apathetic Citizenry: The community requires additional communication to be aware of, understand, and support changes to public, commercial, or residential spaces. Additional Public Service Announcements may be required to prevent time pauses/delays in completing multi-step victory goal projects.</p>
	<p>Active Opposition: Elements of the community have raised issues that require multiple Public Service Announcements or may significantly freeze or delay completion of multi-step victory goal projects. Opposition over multiple seasons may result in changing the focus of or abandoning a project.</p>

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Victory Projects: while actions by Water Management District leaders in response to seasonal weather and news events will keep players in the game, victory requires completion of 4 multi-step projects in 4 of the Water Management Districts. More than one district can choose to pursue the same project type.





Victory Project Checklist					
Location	Any 3 coastal zones (except Naples-Big Cypress, Everglades, Keys)	Any 3 zones (except Naples-Big Cypress, Everglades, Keys)	Any district (requires work in all 4 zones)	Any district (requires work in all 4 zones)	Any 2 coastal zones (except Naples-Big Cypress, Everglades, Keys)
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Budget and Revenue: All Water Management Districts will be able to take at least one action per season (funding will not fall below 1), but will not be able to commit *more than four actions* in a season, no matter how great their balance. Actions in excess of those taken on a turn can be added to the district's balance.

Leaders begin the game with a **starting balance** allowing them to have **1 facility** and **1 equipment item** available for the first season of game events.

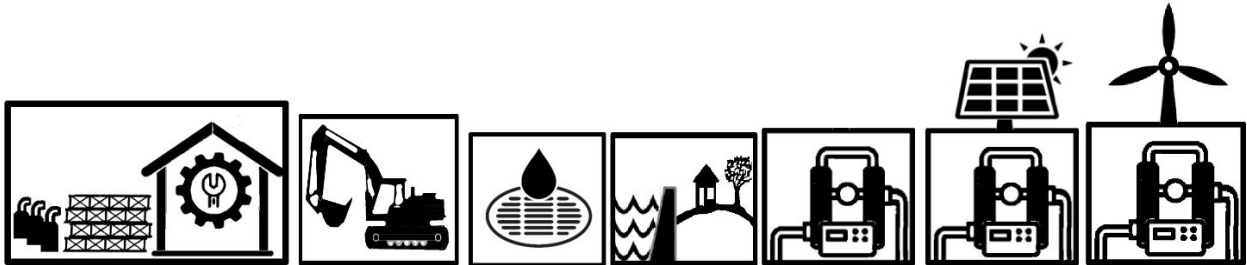
	Balance	2	2	3	2	3
	Water District Funding	Northwest	Suwannee & Kissimmee	St. Johns River	Southwest	South
	4 Actions					
	3 Actions					
	2 Actions					
	1 Action					

Actions: Use of an action credit allows a leader to--

- **Construct a new Facility** (Machine Shop, Truck Depot, Harbor Works, Agricultural Station, Public Communications Center, or Engineering Center). The facility will not produce equipment or resources until the next season after it is placed.
- **Order resources or equipment** from an existing facility.
- **Operate equipment** (run pumps, use excavator to install storm drain).
- **Fund an engineering survey, environmental report, or public service announcement.**

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Facilities and Resources/Equipment: Icons at the beginning of the game represent standard facilities and the services they provide.



Machine Shop: (begins game with one Excavator)

- **Excavator**—create or repair storm drains, sea walls, victory projects within a district (costs 1 action per job).
- **Storm Drain**--lower 1 water level **without requiring an action**.
- **Sea Wall**--lower 1 water level (due to tide) **without requiring an action**.
- **Pump Station**—lower 1 water level if activated.
- **Solar Power Pump Station***--lower 1 water level without requiring an action; in summer, lower 2 water levels in a zone without requiring an action.
- **Wind Power Pump Station***--lower 1 water level without requiring an action; in spring, lower 2 water levels in a zone without requiring an action. May only be installed in coastal zones or Keys.

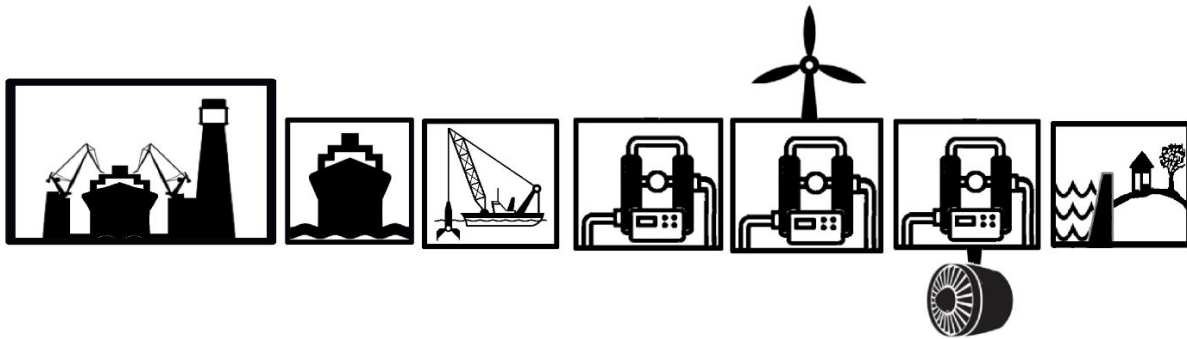
*If a **hurricane** makes landfall in a zone with a wind-, or solar-powered pump, the pump cannot be used for that event.



Truck Depot: (begins game with one Truck)

- **Trucks**—Transports equipment or resources between districts (zones of different colors; moving equipment within a district (same color) does not require a truck) (each truck costs 1 action to transport one tool or resource).

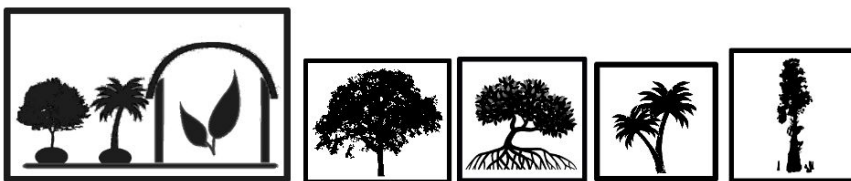
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Harbor Works: (begins game with one Transport or Dredge (player choice))

- **Transport Ship**--Transports equipment or resources between any coastal zones if activated (each ship costs 1 action to transport one tool or resource).
- **Dredge**—create or repair sea walls, victory projects within the district if activated (costs 1 action per job).
- **Pump Station**—lower 1 water level if activated.
- **Wind Power Pump Station***--lower 1 water level without requiring an action; in spring, lower 2 water levels in a zone without requiring an action. May only be installed in coastal zones or Keys.
- **Tide Power Pump Station**--lower 1 water level without requiring an action; in spring-tide event, lower 2 water levels in a zone without requiring an action.
- **Sea Wall**--lower 1 water level (due to tide) **without requiring an action.**

*If a **hurricane** makes landfall in a zone with a wind-powered pump, the pump cannot be used for that event.

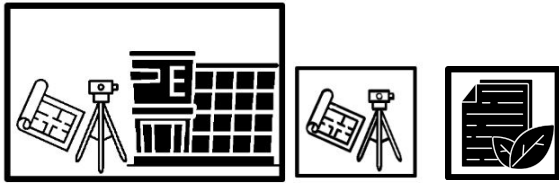


Agricultural Station: (begins game with 2 Trees (player choice))

- **Trees**—deciduous, mangrove, palm, and cypress/pine—lower 1 water level due to rain in any zone. Palm and mangrove lower 1 water level due to tides in coastal zones. Once placed in a zone, trees cannot be moved.

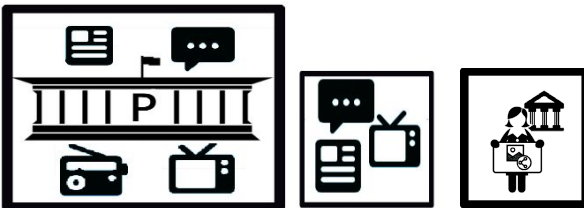
*If a **hurricane** makes landfall in a zone with an agricultural station, the station cannot be used for one season.

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Engineering Center: (begins game with one Survey Crew)

- **Survey Crew**--creates surveys required for project approval (costs 1 action for each survey, 1 survey per season).
- **Engineering-Environmental Report**—required for project approval or to respond to News Event (costs 1 action for each report)



Public Communications Center: (begins game with one Media Relations Team or Public Service Announcement (player choice))

- **Public Service Announcement**--orients the public to a potential water management crisis or issue, enhances citizens' understanding of issues and projects, explains district activities, or seeks public support for changes to public, residential, or commercial spaces (costs 1 action).
- **Media Relations Team or State Government Presentation**—permanently gain one action on budget track for remainder of game (costs 1 action; combined gains of greater than 4 Actions are lost)

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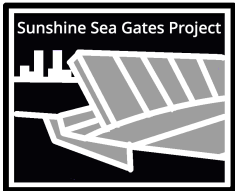




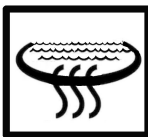
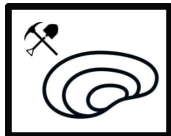


Troubled Waters: Sustainable Living Project and Research Connections

The geology of Florida creates challenges for water managers. A pair of shallow ridges create the watersheds of the north-flowing St. Johns and south-flowing Kissimmee Rivers that run a significant portion of the length of the peninsula. The porous limestone--covered with a thin layer of clay, soil, sand, and silt from ancient oceans--is criss-crossed with underwater rivers that create springs and sinkhole hazards. With its low elevation above sea level and growing population, Florida and its citizens will need sustainable solutions to mitigate rising tides, increased rains, tropical storms, and demands for reliable fresh water supplies. Some research investigation topics for future citizens, scientists, engineers, and community leaders might include . . .

	<p>One Million Trees Campaigns: local communities in Florida, the United States, and worldwide have begun adopting goals to plant more than a million trees for healthy and sustainable forestland and green spaces that provide significant social, economic, and environmental benefits.</p>
	<p>Natural River Corridor Agreements: local governments and private landowners create plans that recognize the unique and special qualities of wetlands to encourage responsible development practices--buffer zones, measuring housing densities and "hard" surfaces, retaining open spaces, and preserving creeks and streams.</p>
	<p>Canal Flood Control: artificial waterways redirecting excess water to purpose-built canals or floodways, which in turn link to natural bodies of water. This widespread method of previous years has unintended consequences in increased pollution concentration, oxygen-poor environments for aquatic plants, and barriers to aquatic and terrestrial animal migrations.</p>
	<p>Beach Renourishment, Sediment Reclamation, and Coastal Reinforcement: these methods can protect the public and private structures behind beaches, increasing public safety and increasing recreation and tourism opportunities. Studies reveal a variety of negative impacts to the ecosystems where the sand is "borrowed" as well as where it is newly deposited.</p>

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	<p>Sea Gates: The engineering projects to establish sea gates to protect historic Venice, Italy and portions of the Netherlands have sparked interest in United States coastal cities as higher sea levels are recorded and "spring tide" events become increasingly common. This option is included in the game to explore possibilities and potential consequences.</p>
	<p>Urban Forests of Deciduous Trees: trees can function as part of a water district's stormwater control system by intercepting rainfall and regulating the flow of water to and through the soil. Forests efficiently store stormwater, return water to the atmosphere, and filter pollutants from runoff.</p>
	<p>Mangrove Forests: Mangroves are valuable ecosystems for environmental protection by playing an important role in erosion control and water filtration in marine estuaries. Saltwater mangrove forests along Florida's fragile southern coastline act to reduce the negative impact of flooding and tropical storms.</p>
	<p>Palm and Seagrape Groves: Palm and sea grape vegetation can help maintain natural beach structure, reduce compaction of sand grains to encourage dune grasses, store water, moderate temperature changes, and reduce erosion.</p>
	<p>Bald Cypress Forests: Riverine bald cypress forests reduce damage from floods and act as sediment and pollutant traps as they cause floodwaters to spread out, slow down, and infiltrate the soil in freshwater swampland and the edges of pastureland.</p>
	<p>Freshwater Springs: Fresh springs did not make it into the final draft of the game, but they are an opportunity and a challenge for water managers and civic leaders in north-central Florida. Their geology and microbiome may spark the interest of some students.</p>
	<p>Sinkholes (North-Central Florida): As underground water resources are used for irrigation and public use they leave fragile limestone shells that give way and create dangerous chasms in north-central Florida. Sinkholes did not make it into the final draft of the game, but their potential to cause destruction may motivate some students to investigate their causes and potential solutions.</p>

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