

# Sustainable Water Management

An innovative and efficient decision support software tool to identify minimum cost strategies

## Optimal water management strategies for hydraulic fracturing in unconventional oil & gas plays

#### Water management challenge

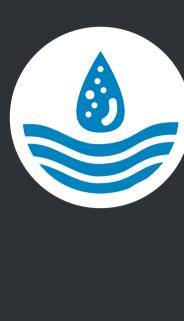
#### Freshwater

Identify fresh water sources, locations and transport / storage options



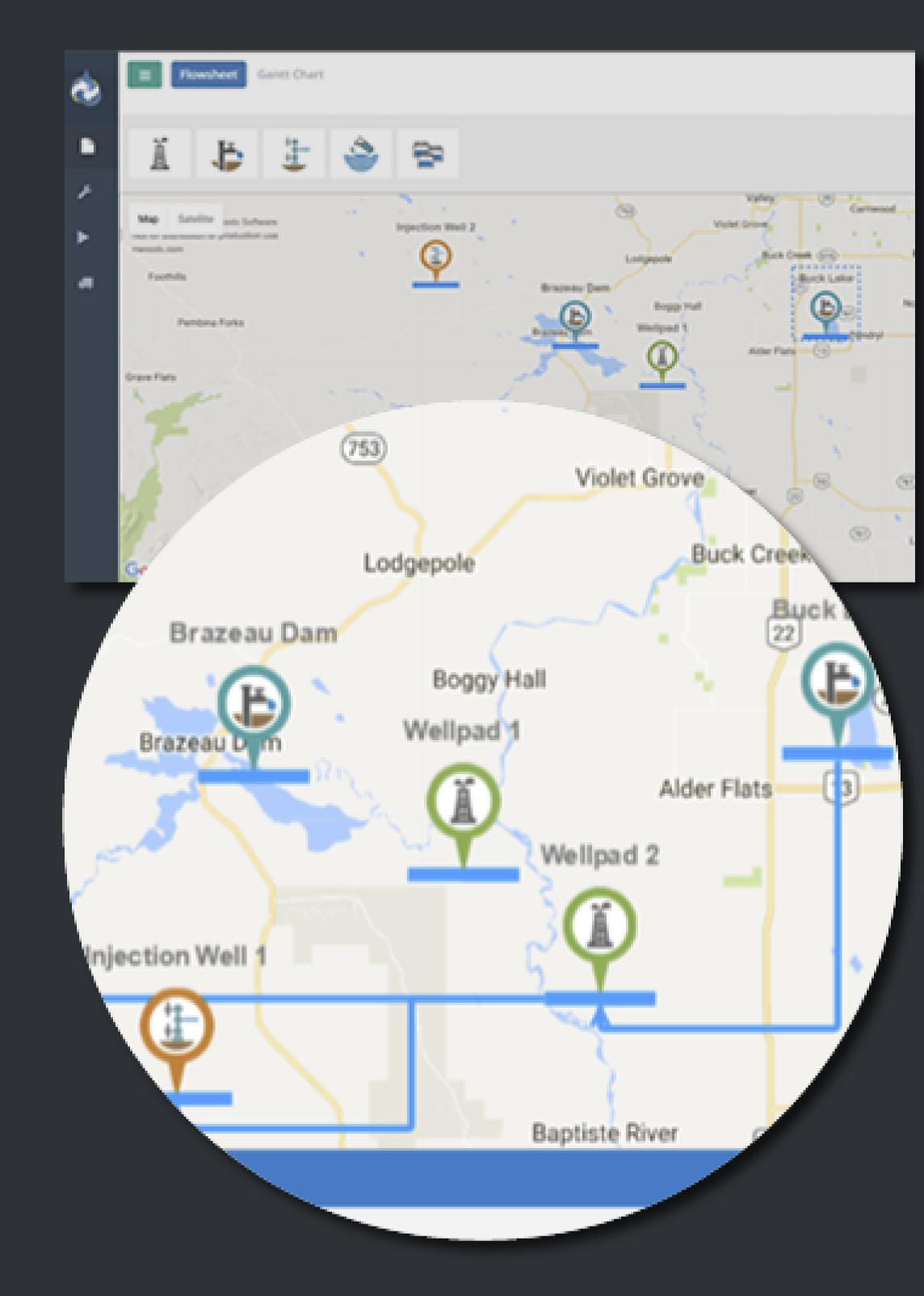
#### Saline water

Evaluate opportunities to increase the use of saline groundwater





Easily incorporate and determine the technical and economic feasibility of sourcing water from industrial/ municipal wastewater sources





#### Injection wells

Determine the lowest cost disposal options including injection wells and third party disposal



#### Water reuse

Explore opportunities for storage/ treatment and reuse of flowback



#### Storage Options

Identify optimal locations and capacities for water storage. Evaluate buy vs. rent options

## The opportunity

The drilling, fracturing and completion of wells in unconventional plays require large volumes of water

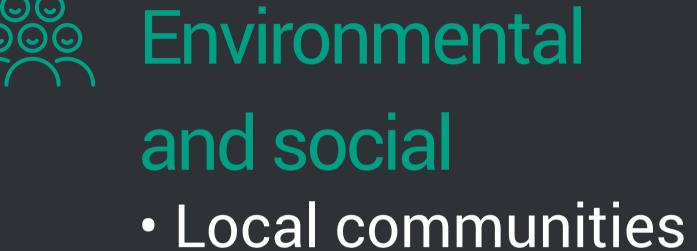


## Water strategy risks

- Availability
  - Right quality Right volume
    - Right time



- Government agencies (Permits) Corporate stakeholders
  - (Transparency)



- Social groups

## Hydropti<sub>TM</sub> Benefits

- Identify solutions featuring up to 30% lower OpEx
- Maximize water reuse and recycling as well as explore the use of alternative water sources
- Centralize all the data and assumptions for transparent decision making
- De-risk the water management plan from technical economic and social/ environmental dimensions
- Incorporate system constraints due to social and environmental concerns
- Automatically generate your Environmental Net Effects reporting from a central location
- Eliminate the challenges associated with the use of multiple spreadsheets

## Hydroptim features



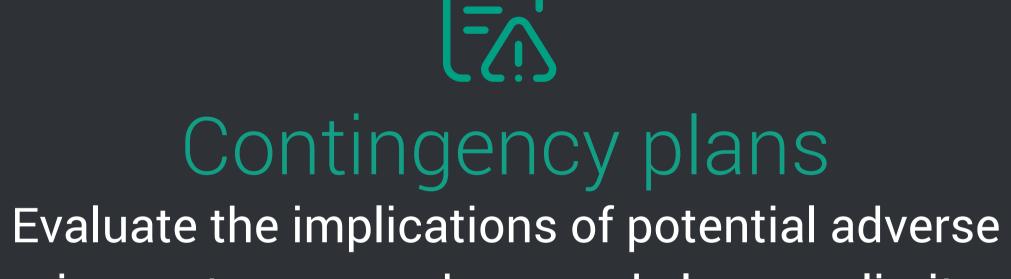
Identify optimal water flows for each period within the duration of the project

Optimal water allocation



the economic implications of each option

Generate alternative strategies and determine

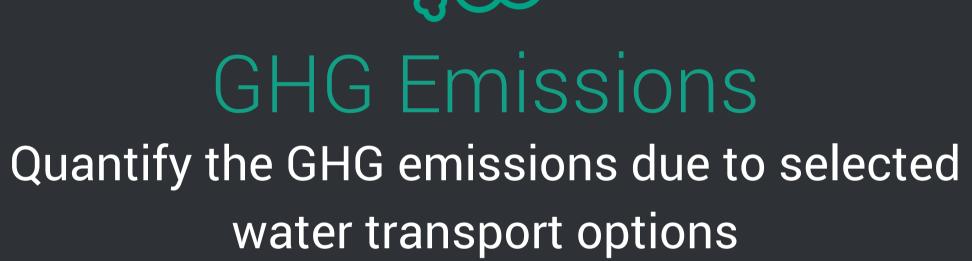


circumstances such as road closures, limits on water withdrawals, etc.



#### Environmental net effects Extend reporting capabilities to include the

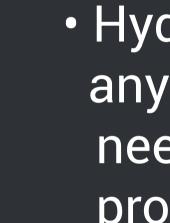
full ENE framework as required by regulations



Cash flow

Determine how water management costs will

influence cash flows for the project



#### An innovative approach

- Hydropti is cloud based, with access from anywhere with an Internet connection. No need for costly software installation procedures.
- Access powerful algorithms to ensure a comprehensive search for the best options
- Interact with the system using a carefully designed Graphical User Interface

Present your results and decision process

with clear charts and interactive maps

- Enjoy the Hydropti user experience with high quality graphics and intuitive workflows
- is enforced using latest encryption technology for data transfer (SSL)

All your data is saved locally. Data security

# Workflow

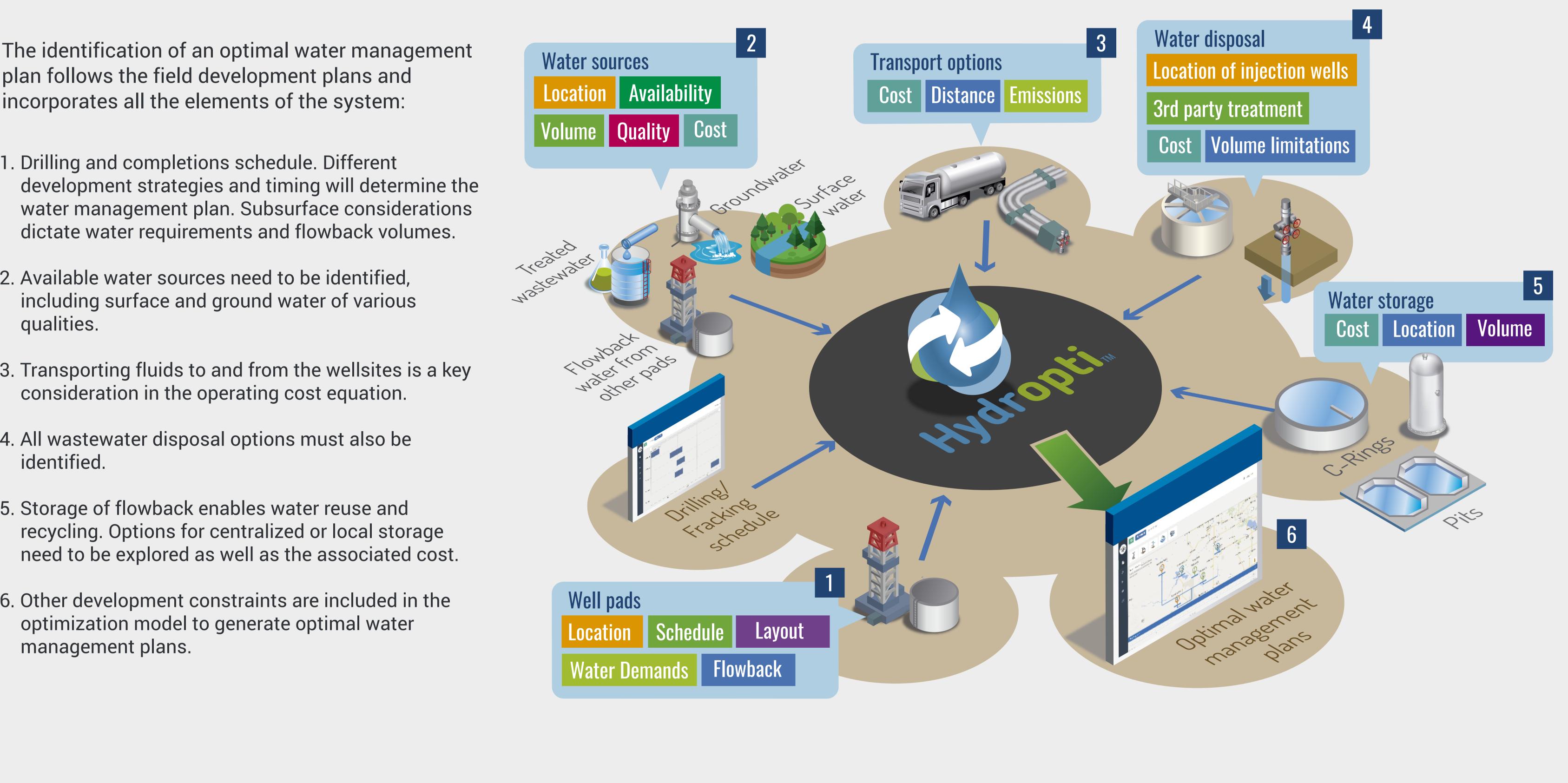
plan follows the field development plans and incorporates all the elements of the system:

1. Drilling and completions schedule. Different

- development strategies and timing will determine the water management plan. Subsurface considerations dictate water requirements and flowback volumes. 2. Available water sources need to be identified,
- qualities. 3. Transporting fluids to and from the wellsites is a key consideration in the operating cost equation.

including surface and ground water of various

- 4. All wastewater disposal options must also be identified.
- 5. Storage of flowback enables water reuse and recycling. Options for centralized or local storage need to be explored as well as the associated cost.
- 6. Other development constraints are included in the optimization model to generate optimal water management plans.



# Value proposition



storage and disposal options, including flowback water treatment and reuse, for

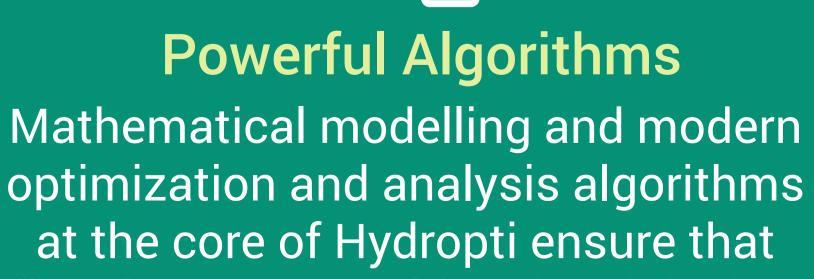
maximum efficiency



share sensitive information with peers

Lifecycle Analysis Determine the most cost-effective water transportation options – truck, pipeline, layflat hose- as well as storage and treatment

capacities and locations



at the core of Hydropti ensure that all options are considered and the best strategies can be identified



Fully understand the implications on water requirements of long term development for the

play, including a full development scenario and associated time-based decisions



engagement, water resources engineering as well as mathematical modelling, optimization and software development

# Partners

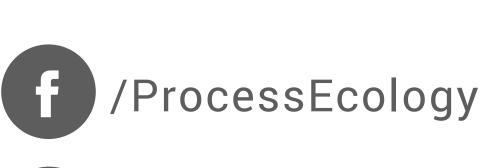








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