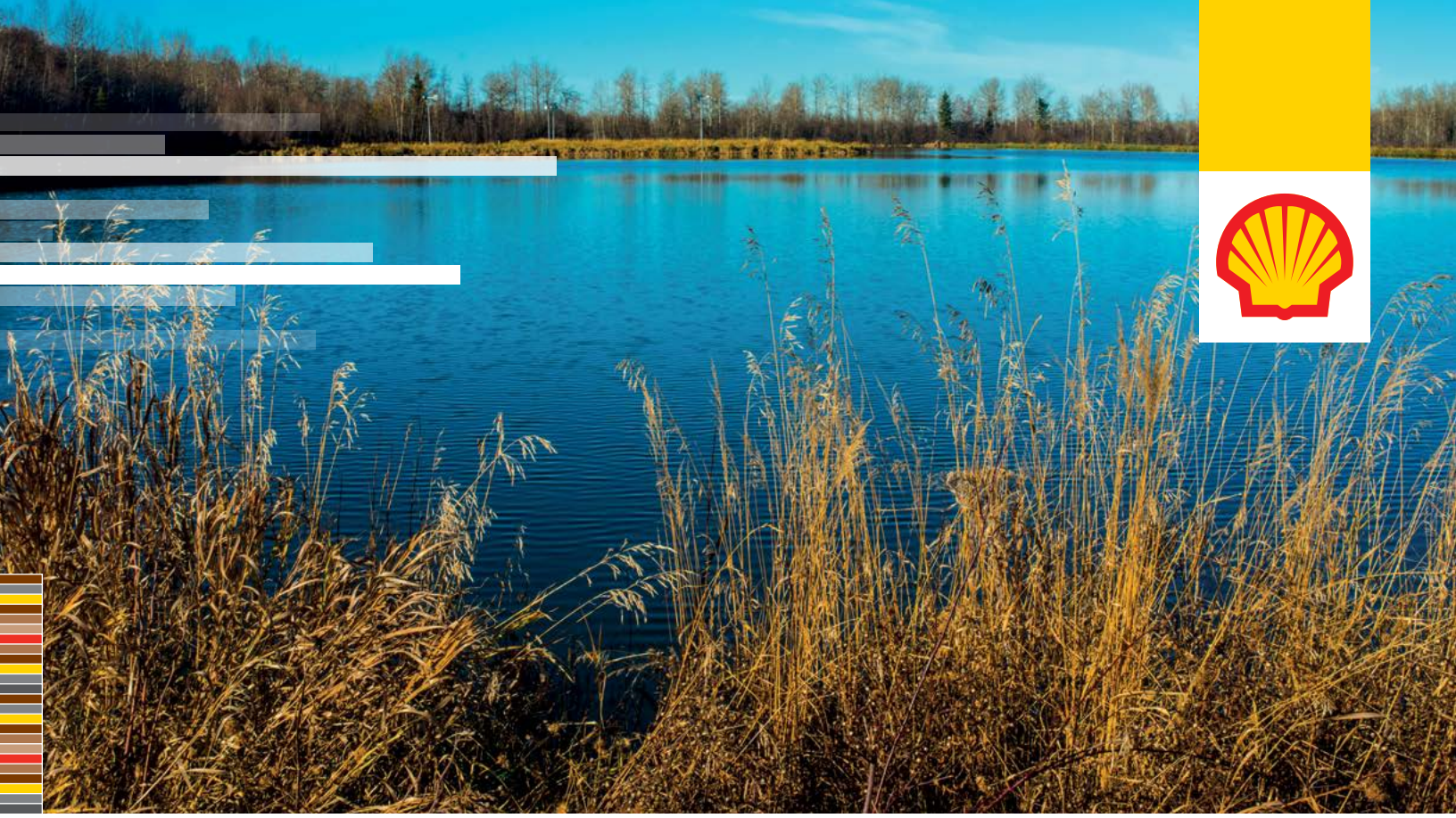


Surface water near Shell's Fox Creek Asset in Canada.

SHELL ONSHORE OPERATING PRINCIPLES IN ACTION: WATER FACT SHEET

Shale oil and gas continues to play an important role in meeting global energy demand. Shell's[1] shales business uses advanced technologies, including horizontal drilling and hydraulic fracturing, to unlock these resources safely and responsibly.

Today, our shale operations are focused on six assets, which operate according to five global principles, the Onshore Operating Principles. These principles govern the onshore shale (oil and gas) activities where we operate and where hydraulic fracturing is used. The principles cover safety, air quality, water protection and usage, land use, and engagement with local communities. We review our Onshore Operating Principles annually and update them as new technologies, challenges and regulatory requirements emerge. In 2016, we updated the Principles to include how we manage any potential induced seismic events from our wastewater injection or hydraulic fracturing activities. We are transparent in our activities and proactively engage with communities, industry participants, regulators and other stakeholders to bring about improvements in the sector.

1 Royal Dutch Shell plc and its various subsidiaries and affiliates (the "Shell Group") are separate legal entities. In this Fact Sheet the expression "Shell" is sometimes used for convenience where references are made to those entities individually or collectively. Likewise, the words "we", "us" and "our" are also used to refer to companies in the Shell Group in general or those who work for them, and these references do not reflect the operational or corporate structure of, or the relationship between, entities in the Shell Group. Nothing in this Fact Sheet is intended to suggest that any entity in the Shell Group, including Royal Dutch Shell plc, directs or is responsible for the day-to-day operations of any other entity in the Shell Group.

Water

Water Management

Shell approach: We manage our water sourcing, use and disposal in line with our Onshore Operating Principles and regulatory requirements. The availability and quality of water, the local environmental conditions and the regulatory requirements vary from location to location. Hence, we develop a tailor made water management strategy for each of our shale assets. This strategy identifies short and long term water needs and options for:

- Water sourcing;
- Recycling and sharing of water;
- Treatment and disposal of water that cannot be re-used; and
- Transportation and storage.

After each option has been considered and the overall water strategy finalized, we engage our stakeholders, seeking their input and addressing any concerns. The water management strategy is periodically reviewed, re-evaluated and modified as needed, to address changes in our operational needs, regional water use and regulatory requirements.

Water requirement: We use water throughout our operations, in both drilling and hydraulic fracturing, to maintain pressure in the borehole, lubricate the drill bit and carry drill cuttings[2] to the surface. On volume basis, 99.9% of our hydraulic fracturing fluid is water and sand and the rest chemical additives. Hydraulic fracturing fluid is pumped into the well under high pressure to create fractures in the shale, enhancing the flow of oil and natural gas. The amount of water needed for drilling and hydraulic fracturing varies from basin to basin.

Chemical Additives: Chemical additives are needed in the hydraulic fracturing fluid to carry sand, reduce friction and prevent bacteria. Since 2015, we have optimized the composition of our hydraulic fracturing fluids.As a result of this optimization, we have achieved approximately 50-60% reduction in chemical additive volumes.

Shell's water manager inspects a waterway in Canada.

Currently, on volume basis, approximately 0.1% of our hydraulic fracturing fluid is chemical additives. 0.005% of the total volume could contain benzene, toluene, ethylbenzene and xylene (BTEX). We do not use hydraulic fracturing fluids that contain diesel.

We support full disclosure of the chemical additives used in hydraulic fracturing fluids for Shell-operated wells. We do not currently use gas or dry chemical additives in our hydraulic fracturing fluids. All of our suppliers provide information to FracFocus, except presumably that information which can be kept proprietary based on applicable Trade Secret provisions within the Occupational Safety and Health Administration (OSHA).

We support regulation to require suppliers to release information on chemical additives and engage our suppliers to advocate maximum disclosure. We have stringent procedures for handling hydraulic-fracturing chemicals. Material Safety Data Sheet information is available on site where wells are being hydraulically fractured.

Water scarcity: The availability of fresh water is a growing challenge in some regions of the world. At Shell, we take this challenge seriously and recognize the need to preserve fresh water for multiple beneficial uses. We report our operations in water scarce areas in our annual Sustainability Report.

2 Drill cuttings are broken bits of solid material removed from a borehole.

Water

Assessment: Our water management strategies specifically assess and address water scarcity. We engage external experts and consult external water maps to understand overall conditions and groundwater stress. These maps compare withdrawal and recharge rates to determine stress levels (extremely high, high, medium and low). Based on this information, we complete a risk assessment process. For example, in our Permian asset in Texas (US), we have carefully assessed the water availability situation in the Delaware Basin area.

Shell's operations, in conjunction with all other current and projected ground water usage, are assessed not to adversely impact fresh or brackish water availability in the area in the future. Finally, our water management plans describe long-term risks to water availability and suggest mitigations.

Water use: We strive to minimize the use of water in our shales operations. For example, we look for new well designs and hydraulic fracturing technologies that may replace or substantially reduce the amount of water and total fluid used for hydraulic fracturing operations.

We only use the water that is needed for successful completion of our drilling and hydraulic fracturing operations. In addition, Shell collaborates with other operators to share any excess water volumes.

Water sourcing: Depending on local hydro-geologic conditions, we typically use a combination of freshwater, brackish groundwater, produced water and waste water.

WATER MANAGEMENT IN FOX CREEK ASSET

We have made continuous improvements to our water management in our Fox Creek asset in north-western Alberta (Canada).

- Our term license on Losegun Lake is for 4 million m^3 of water per year for five years. In 2017, we only used ~1.2 million m^3 of water from the lake because we were able to reduce our overall water demand and use alternative water sources instead.
- Our priority alternative water source for our Fox Creek operations is the Town of Fox Creek's waste water. In 2016, Shell signed an agreement with the Town of Fox Creek to use its waste water in our completions operations. In return, Shell paid for improvements to the Town of Fox Creek's waste water treatment facilities. The Town's waste water replaces about 400,000 m^3 of fresh water a year in our operations. We have pursued similar initiatives in our Groundbirch asset in north-east British Colombia (Canada).
- In March 2016, Shell constructed a 300,000 m^3 water hub in Fox Creek. This hub is licensed to store fresh water and connects through pipelines to our well pad locations. This water hub is a critical piece of infrastructure in our development plan because it allows us to withdraw water when it is most available, such as during spring run-off, and store it for future use when the season is drier.
- An average well uses 40,000-60,000 m^3 of water. Through pilots in 2018, we are actively working to reduce this water demand by 30%.

Water

We actively strive to reduce and ideally eliminate our freshwater intake for our drilling and hydraulic fracturing operations by increasing our recycling capacity and, where appropriate, using municipal water. Freshwater intake is reported in our annual Sustainability Report.

Whenever we use freshwater, we deploy responsible withdrawal practices to minimize the risk of adversely impacting the aquatic and ecological habitats, to support local communities and to consider other users. These practices may include withdrawing surface water only during high flow stages. Across our shale portfolio, we work with local water boards and/or other appropriate regulatory agencies to identify suitable water sources.

Flowback and produced water management

Our approach: We strive to minimize the volume of flowback and produced water generated by our shales operations. Each asset tracks and reports these volumes externally as required by relevant regulations. Our total waste water volumes are reported in our annual Sustainability Report.

Overview of Shell's Water Sourcing in its Shale Assets

Water Sourcing (2017/18)	Availability of Water for Oil and Gas Production	Freshwater (%) and source (%)	Non-freshwater (%) and source (%)	Measures to reduce freshwater consumption as reasonable practicable
Appalachia	Abundance of freshwater, source of which varies. annually based on operations	65% Public utilities – 3% Ground water – 4% Surface water – 93%	35% Recycled produced water – 100%	Recycling produced water
Permian	Abundance of brackish water	0.7% Public utilities – 100%	99.2% Brackish water – 83.5% Recycled produced water – 15.7%	Using brackish water and recycling produced water
Alberta Light Tight Oil (ABLTO)	Freshwater available in the region, availability varies by year. Recycled municipal wastewater available	75% Public utilities – 33% Surface water – 66%	25% Grey water from utilities – 100%	Using grey water from public utilities
Groundbirch	Abundance of produced water. Recycled municipal wastewater available	3% Surface water – 100%	97% Grey water from utilities – 4% Recycled produced water – 96%	Recycling produced water and using recycled municipal wastewater
Foothills	Abundance of freshwater	98% Surface water – 100%	2% Recycled Water – 100%	Fresh used for cooling purposes at the gas plants. Less fresh water used due to end of life activity
Argentina*	Abundance of freshwater	100% Surface water – 100%	0%	Limiting withdrawals to only volumes needed

**Shell's Argentina asset is still in a development phase, which means that water infrastructure is not yet fully developed.*

Water

Management: We use a combination of methods to help manage our flowback[3] and produced[4] water. We transfer our flowback water to a disposal facility due to difficulty processing the water at site given the sand/sediment content. Meanwhile, we take produced water to a treatment plant for processing and then reuse it, as much as possible, for additional wells in a single field. We are investigating the use of produced water for drilling. This reduces our overall use of fresh water and the amount of produced water subject to disposal. When recycling is not reasonably practical and/or volumes exceed our operational needs, we may store produced water, share it with other producers or dispose of it in an environmentally responsible manner.

Disposal: We either transfer the produced water to a disposal facility and/or inject it into nearby disposal wells in accordance with regulatory requirements and Shell standards, which often exceed those regulatory requirements. All third-party waste management companies are audited against Shell's waste management standards and all treatment and disposal facilities are assessed to verify they meet regulatory requirements and Shell standards.

Overview of Shell's Water Recycling and Reuse in its Shale Assets

Water Recycling and Reuse 2017/18	Flowback and Produced Water (%)
Appalachia	100%
Permian	21%
Alberta Light Tight Oil (ABLTO)	0%
Groundbirch	76%
Argentina*	0%

**Shell's Argentina asset is still in a development phase, which means that water infrastructure is not yet fully developed.*

WATER MANAGEMENT IN APPALACHIA ASSET

We have maximized use of our own produced water and third party produced water for hydraulic fracturing in our Appalachia asset (USA). We have improved fracking chemistry compatibility to increase the type of produced water we are able to recycle. For each hydraulic fracking operation, we recycle as much third party produced water in addition to Shell produced water. We have 11 water-sharing agreements with third parties. We have not sent waste water from our core acreage to produced water disposal wells in over two years. We partner with Pennsylvania regulators, the Centre for Responsible Shale Development (CRSD) and third party water treatment companies to trial new water sharing and treatment technologies to maximize water recycling and minimize deep well injection. For example, we have spearheaded a partnership with a third party treatment company to deploy the first large-scale crystallizer to the north-east Pennsylvania region, which treats produced water from numerous operators in the region and returns the water to the hydrologic cycle. This has reduced and often eliminated disposal of produced water to disposal wells for many of the operators in the region.

Shell's Salt Water Disposal (SWD) facility in Permian Asset in West Texas, (USA).

3 Flowback water is the water and associated fluids produced in the first few days after hydraulic fracturing is completed. It typically contains sand, salt and a percentage of the chemicals used in the hydraulic fracturing process.

4 Produced water is water trapped in underground formations that is brought to the surface during oil and gas exploration and production. It may include water from the reservoir, water injected into the formation, and any chemicals added during the drilling, production, and treatment processes.

WATER RECYCLING IN PERMIAN ASSET

We have taken steps to improve water recycling in the Permian asset in west Texas (USA) for one of our focused development areas. Prior to the recycling project, the asset transported brackish groundwater via a 20km (13 mile) temporary pipeline for use in hydraulic fracturing operations due to the limited local availability of brackish groundwater. We identified an opportunity to replace most of this brackish groundwater supply by recycling produced water near our Johnson Block 53 development area. In September 2016, the Permian assert commissioned the now fully functional Johnson Block 53 recycle facility that currently receives produced water from three Salt Water Disposal (SWD) facilities.

The produced water is transferred from the SWD facilities after normal biocide, chemical addition, gravity separation and filtration is complete and prior to the injection into well pumps. Produced water recycle impoundments at the Block 53 facility are equipped with floating oil booms to manage any entrained oil and are also covered with netting to prevent birds from entering/contacting the impoundments. Aerators are installed and operated to mitigate odors and sulfur reducing bacterial growth by keeping the water oxygenated.

The combined total capacity of recycled produced water storage is approximately 103,000 m^3 and brackish groundwater storage is approximately 4,800 m^3. The three SWD facilities have the capacity to supply 8,000 m^3 per day of produced water for recycle. Currently, in this area of our Permian asset, approximately 15.7% of water used in hydraulic fracturing is recycled produced water (the remaining 83.5% is brackish groundwater) and Shell plans to increase the recycle water percentage to 90%.

Produced water storage: We keep produced water in storage tanks or ground surface impoundments until disposed or reused. These tanks and pits have both primary and secondary containment in the form of double liners/walls, berms and interstitial leak detection monitoring. They meet regulatory requirements as well as Shell standards, which often exceed those regulatory requirements.

We have eliminated the use of unlined storage pits at well sites for primary containment of produced water. We only use unlined earthen pits for storage of fresh water. To protect wildlife, we install netting to prevent birds and larger mammals from accessing our pits. Our facilities are access controlled with fencing to prevent unauthorized entry into the area or access to the pits.

Waste Management

Our approach: Management of exploration and production wastes are specified by relevant regulations in Shell's operational areas. In addition to regulation, Shell sets out its own corporate minimum standards related to management of waste materials. To the extent practical, we reuse or recycle produced water or flowback water to reduce use of freshwater and the volume of waste. State or provincial regulations in our current operating areas preclude the use of exploration and production wastes for uses other than for drilling or hydraulic fracturing operations.

Residuals: At Shell, we take great care in processing post-drilling residuals in an environmentally responsible manner. Each of our assets has its own waste management plan, which considers local conditions and disposal options. In general, post-drilling residuals – both solid and liquid – are first sampled to determine chemical makeup for waste classification. After this, residuals are managed and/or disposed in accordance with their classification, applicable regulations and Shell waste management requirements.

Water

In Canada, sampling is not done unless there has been a significant change in operations as there is extensive benchmarking data already available. Solid residuals are typically disposed in permitted local landfills. Meanwhile, liquid residuals can be disposed or recycled depending on whether they are oil or water based.

NORMS: Our site-specific waste management and handling plans also cover identification and management of naturally occurring radioactive materials (NORMs). In general, we monitor post-drilling residuals for NORM using portable monitoring equipment before transporting materials (as necessary) to special permitted facilities for disposal or decontamination in a safe manner. We also screen pipes, tanks and equipment for NORMs before sending them to scrap.

Water Protection

Surface water: When we select sites for our operations, we avoid disrupting sensitive areas, including surface waters such as rivers, streams and wetlands, as much as reasonably practicable. We routinely exceed regulatory setback from surface water for well construction and production activities, and observe regulatory requirements established to protect surface waters.

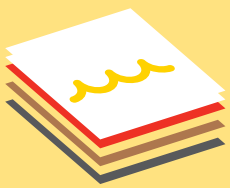
Groundwater: Potable groundwater aquifers are isolated from the hydrocarbon-producing shale formations by several thousand feet of impermeable rock. However, we often need to drill though potable groundwater aquifers to reach shale formations. Hence, we design our drilling, hydraulic fracturing and production activities in a way that maintains isolation from potable groundwater aquifers. Except for certain proprietary information, we share with regulators our well and completion designs, operations reports, as well as our plans to protect aquifers. We engage local communities to seek their input into our plans and feedback on our activities. We comply with the regulatory requirements and our own engineering and spill prevention standards, which often exceed regulatory requirements.

Well design: Before we drill a well, we conduct a hazard assessment to analyze risks to groundwater aquifers and develop control measures to reduce those risks.

In new areas, we gather and evaluate existing and publicly available geologic and geophysical data relevant to the area before we drill a well. We use robust well design and construction to prevent gas or oil in the deeper target production zones from reaching other geologic formations, including potable groundwater aquifers. We apply Shell's Global Wells Standards to well design, drilling, completion and well intervention activities. These include comprehensive well planning, execution, assurance and maintenance requirements. We conduct formal technical review and assurance for all wells, prior to construction. Key well design measures include:

- During drilling of the top segment of the well (surface casing string), we use only air, water or water-based drilling fluids through and below the base of potable groundwater aquifers.
- We employ at least two physical barriers (surface and production casing strings), consisting of steel casing and cement between the well bore and potable groundwater aquifers.
- These casing strings also isolate potable groundwater aquifers from hydraulic fracturing fluids.
- We utilize secondary containment (e.g. plastic liners or perimeter berms) on the well pad surface to prevent surface spills from reaching nearby soils and surface water and groundwater.
- We proactively monitor indicators for potential spills or leaks during operations. We have a strong internal and external reporting culture.

WATER
Shell conducts its operations in a manner that protects groundwater and reduces potable water use as reasonably practicable.



Water

Well integrity: We monitor wellbore integrity before, during and after hydraulic fracturing and during production. We test the integrity of casing shoes, casing, cement, and well-head equipment before hydraulic fracturing, using site-specific pressure testing and/or detection equipment. We implement standard operating procedures around wellbore integrity, focusing on obtaining cement to surface utilizing a differential valve (DV) tool and delivery of excess cement.

In the rare event where cement does not return to surface, we conduct a cement quality evaluation using a cement bond or acoustic logs, and we do not hydraulically fracture wells unless we have pressure tested for wellbore integrity. We monitor surface casing pressure during hydraulic fracturing to confirm no communication with potable groundwater. We also periodically monitor the fractures and the fluids using micro-seismic technology. When we acquire assets, we evaluate the assets' wells for conformity with our safety and operating principles and put in place a plan with a timeline for rectifying any inconsistencies or gaps.

Response: We have controls in place to continuously evaluate well integrity indicators. We have emergency response plans that account for the local surroundings and enable us to respond quickly and effectively to any integrity events. These plans address, among other things, safety to the local community and spill prevention and containment at well pads. In the unlikely event of an isolation issue, we will either take immediate remedial measures to correct the issue or plug and abandon the well. We also report any environmental releases in accordance with applicable regulatory requirements. We manage inactive wells in accordance with relevant regulations in our operational areas.

Off-set wells: As part of the initial hazard assessment for each well, we assess the risk of impacting existing wells or interacting with subsurface geologic features/ faults, resulting in migration of fluids into the environment or adjacent wells. Based on this assessment, we develop control measures to mitigate identified risks.

Groundwater Testing: We assess groundwater quality in areas where we operate on an asset specific basis. The area, type and frequency is dictated by such factors as relevant regulations, our On-shore Operating Principles and local circumstances (such as population density):

- **In Appalachia**, we take samples at every public water supply within a 4,500 feet radius from a planned well pad. After completion activities, we take a representative sample of private water supplies within 2,500 feet radius of a well pad.
- **In Permian**, we install a monitoring well and collect samples pre-and post-drilling in locations where drinking water supply wells are located within 0.5-mile upgradient or cross gradient of our operational areas.
- **In Groundbirch**, we conduct pre-and post-drilling sampling of residential wells with1.8-mile radius of a well pad.
- **In Alberta Light Tight Oil (ABLTO)**, we conduct pre- and post-drilling sampling of any residential wells within 0.6-mile radius of a well pad. Continuous post-drilling monitoring is not conducted.
- **In Argentina**, we assess groundwater quality using monitoring wells installed within our operational areas. These wells are sampled every 6 months.

To assess potential changes in water quality from our operational areas overtime, we compare samples to baseline groundwater data collected during previous years as well as publicly available data.

Surface water testing in our Foxcreek Asset in Canada.

Research and collaboration

We are collaborating with others in the oil and gas industry, regulators, academia and subject matter experts to develop new technologies and management practices around water sourcing, use and disposal. We are members of International Petroleum Industry Environmental Conservation Association (IPIECA)'s Water Working Group where we collaborate with other oil and gas companies to develop a water improvement agenda and issue guidance documents for water management.

We work with the Rice University Shell Center for Sustainability, which brings together expertise from several Rice University departments in the area of membrane fabrication and examines applications where membrane science could enable innovations in water management.

The center focuses on desalination, water supply in remote or developing areas and managing produced waters and brines in energy production. We also collaborate with the Nanotechnology Enabled Water Treatment (NEWT) consortium at Rice University to develop new technologies for water treatment.

DOMESTIC BASELINE WATER WELL SAMPLING PROGRAM IN GROUNDBIRCH ASSET

There are many existing regulations in British Columbia (Canada) intended to protect groundwater. In addition to adhering to applicable regulations, Shell has developed and is implementing its own groundwater protection measures intended to validate the effectiveness of the regulations. We have a program to sample and test active domestic water wells in our lease area:

- Commitment to offer sampling of all active wells on a five-year basis.
- More than 120 water wells and 10 springs were sampled by qualified groundwater and drilling consultants to establish a baseline.
- Approximately 20% of the residential water wells re-sampled annually.
- Landowner consent and assistance to compile a summary of basic water well information.

This program delivers multiple benefits, including ongoing data collection each year, opportunities to consolidate radius sampling and baseline testing and spatial coverage across the Groundbirch lease area. To date, the results indicate no significant differences between the baseline events conducted and the subsequent sampling events. Shell will continue to monitor water quality and evaluate trends, if present. We also continue to conduct pre-post (radius) sampling within 1.8 miles of completion activities and have a risk-based groundwater monitoring network.

ADDITIONAL RESOURCES

- Shell Global/Fresh Water
  www.shell.com/water
- Shell Global/Sustainability/Climate change and energy transitions
  http://www.shell.com/sustainability/environment/climate-change.html
- Shell Sustainability Report 2017
  https://reports.shell.com/sustainability-report/2017/
- Shell Global/Shell's principles for producing tight/shale oil and gas
  http://www.shell.com/energy-and-innovation/natural-gas/tight-and-shale-gas/shells-principles-for-producing-tight-shale-oil-and-gas.html
- Rational Middle: Realities of Drilling: Extended and Recut
  http://rationalmiddle.com/realities-of-drilling-extended-and-recut/
- Houston Energy Dialogues; Energy Dialogues Summary Report (June 2017)
  https://www.bakerinstitute.org/media/files/research_document/20c6e148/CES-pub-EnergyDialogues-062917.pdf
- Rice University Shell Center for Sustainability
  https://shellcenter.rice.edu/