



An Overview of the Alton Natural Gas Storage Project

October 2007





Outline

- Purpose / Basic Project Description
- Project Location
- Salt Geology
- Leach Water Sources
- Brine Disposal Options
- Surface Facilities for Cavern Leaching
- Surface Facilities for Gas Handling
- Regulatory Issues
- Environmental Issues
- Control and Safety





Purpose / Project Description

- This project will store 113 x10⁶ m³ (4 bcf) of natural gas for later production when the demand or price is higher.
- This project will support other projects such as the import of LNG, local gas distribution networks, pipeline flow balancing and commodity trading.





Project Location

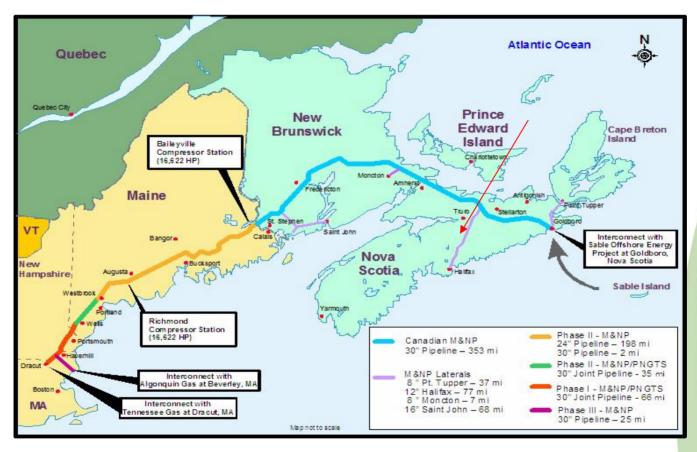


Figure 1 – Project Location [2].





NATURAL GAS STORAGE LP

Salt Geology

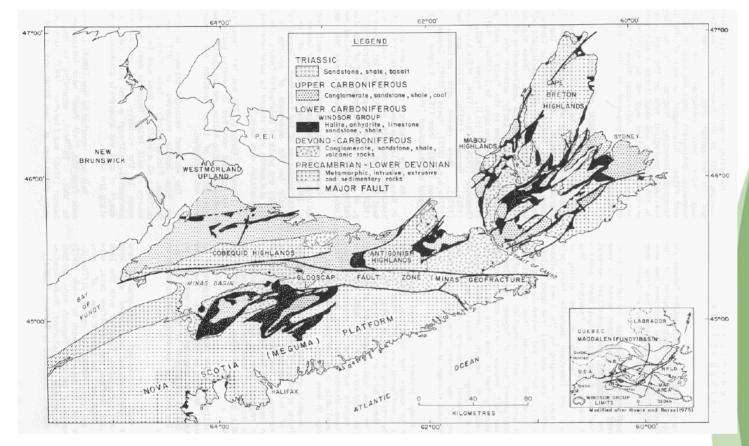


Figure 2 – Regional Geology of Nova Scotia [1].





NATURAL GAS STORAGE LP

Salt Geology

BASIN DEPTH	slowly	and the state of t	erately easing	rapidly >		
SALT ABUNDANCE	and strengt	increasing				
TECTONIC-SEDIMENTOLOGIC	°	platformmobile_basin				
DEFORMATION	incre	asing complexity	and intensity			
SALT BASIN TYPEHalotectonicHalokinetic						
TECTONIC BEHAVIOUR (after Martinez, 1974)	a vitrante	passive role		no Noh		
FOLDING		\sim	/ / / / / / / / / / / / / / / / / / /	4		
CLASSIFICATION TYPE	TYPE A	TYPE B	TYPE C	TYPE D		
DEFORMATION INTENSITY® FOLDING TYPE	Slight Gentle,open Iow dips	Moderate Open moderate dips	Severe Subisoclinal, isoclinal, dips low to steep & overturned	Extreme Intrusive—diapiric character apparent		
EXAMPLE AREA EXAMPLE DEPOSIT	Hants-Colchester Shubenacadie- Stewiacke	Hants-Colchester Beaver Brook	Canso-Bras d'Or McIntyre Lake?	Cumberland Pugwash		
A reflects potential apostatio	anding influence	8.373.HQ - FLL 714 - 5 - 5	VI.18001 0801			

① reflects potential geostatic loading influence.

evaporite tectonics are complicated by heterogeneous lithology, facies variation and uneven distribution of salt in the Windsor Group. any type may occur in simple or complex graben or half graben basins.

Figure 3 – Salt Deposit Deformation Types [1].





NATURAL GAS STORAGE LP

Salt Structural Settings

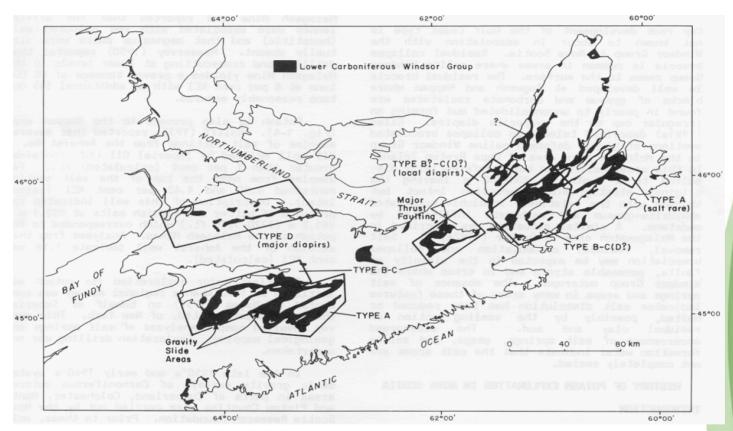


Figure 4 – Structural Settings of Nova Scotia Salt Deposits, see figure 3 for description of deformation types.





Salt Geology

- The Windsor Group rocks in the Shubenacadie Basin form a synclinorium (graben) trending northeastsouthwest generally with younger units in the central portion and the older units around the periphery. The axial area of the graben contains a large mass of relatively undisturbed stratified salt [1].
- The salt is stratified and only slightly deformed except near the north-western limits. Some faulting is apparent in the overlying rocks in the central part of the area, but this is believed to be of minor consequence [1].







Salt Geology

The deposit's thickness, its relatively undisturbed nature,"
its great lateral extent and reasonable depth, and the
virtual absence of salt springs, all favor use for the future
development of mines and underground storage facilities.
Although this deposit may be of economic value, it has
not as yet been utilized [1].





Salt Core Log

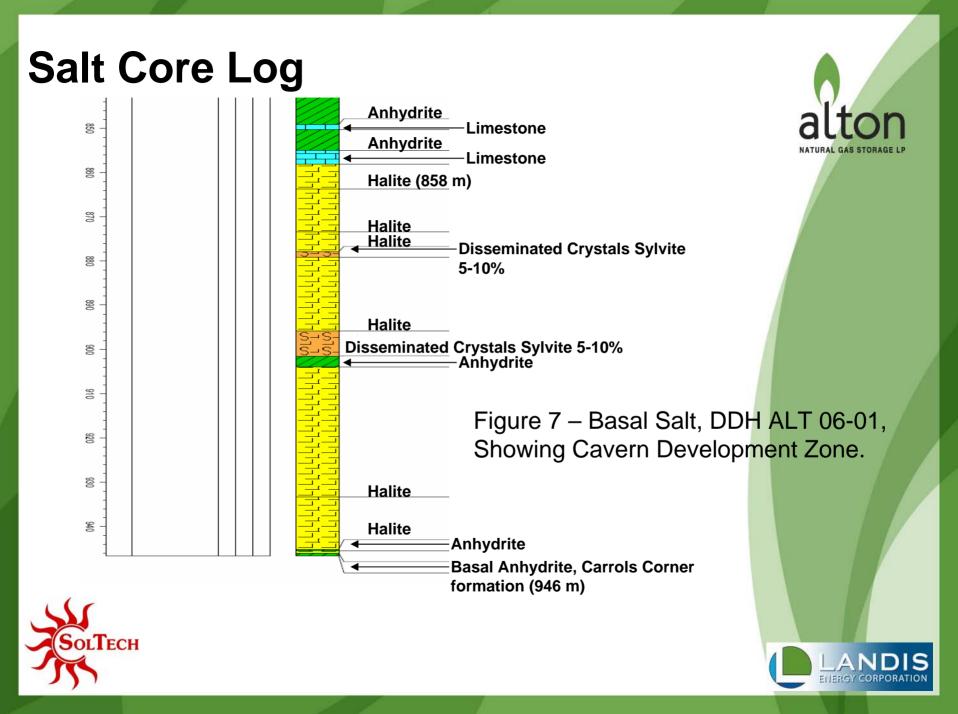
Hy-Grade Geosci Environmental and Earth Investigations	ence D Science	0 John Savage Av artmouth, Nova S B3B 2E6 tel: (902) 482-202 fax: (902) 461-993	cotia 4	Geological Log
Area: Alton, Nova Scotia	Operator: Landis Mining Corporation			
Well Number: ALTON-06-01	Drilling Contractor: Logan Drilling Limited			
Location:UTM NAD 83 Coordinates Northing:		5005009	Easting: 478704	
Elevation: Grd. K.B.			Casing	
Spud Date: May 8, 2006	Abandon Date:			
Total Depth: 946.62 m	Directional Survey: Single Shot Sperry Sun			
Oldest Formation: Stewiacke Form	Core Diameter: HQ 100-470 m			
Logged By: Robert Cuthbert Jason Muise	Plotted By: Jason Muise Hy-Grade Geoscience			
David Carter		Date:		
Date:		Cement:	1. 100	m, BOP Casing
Drill Fluid:1. Water based polymer 2. Saturated salt			2. 470	m, Top of Salt

alton NATURAL GAS STORAGE LP

Figure 6 – Core Log Specifications.







Shubenacadie River Data

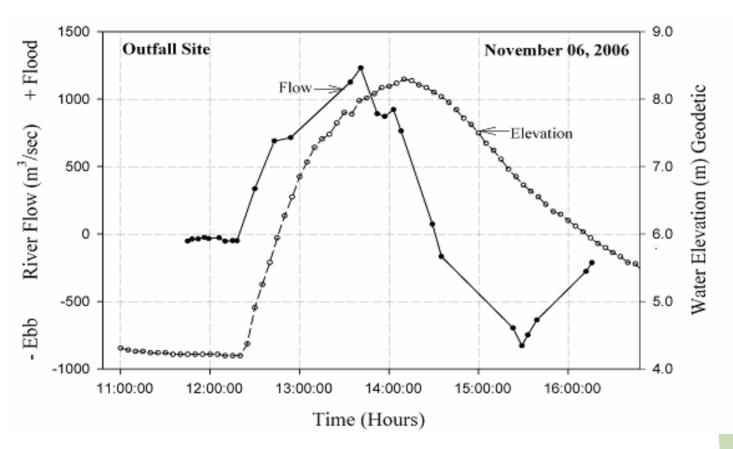
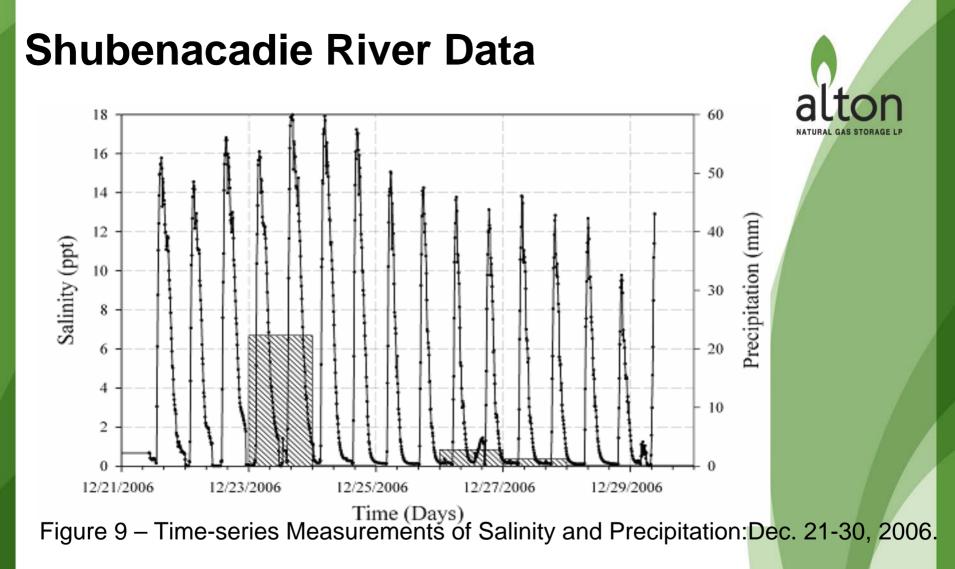


Figure 8 – River flow and Water Elevation Measurements on Nov. 6th 2006.

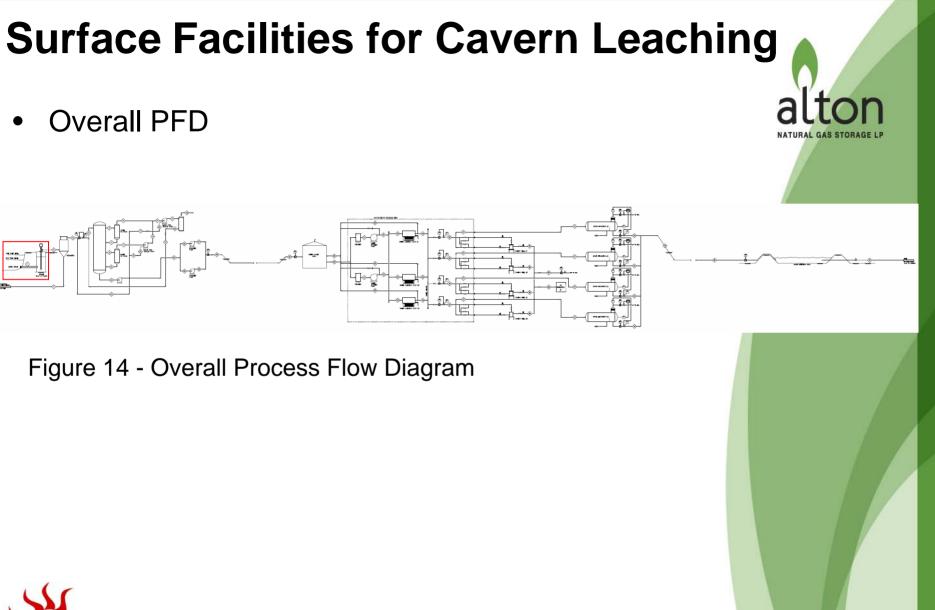
















Surface Facilities for Cavern Leaching

• Leach Water Intake

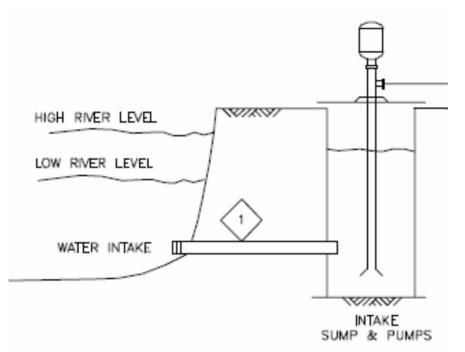
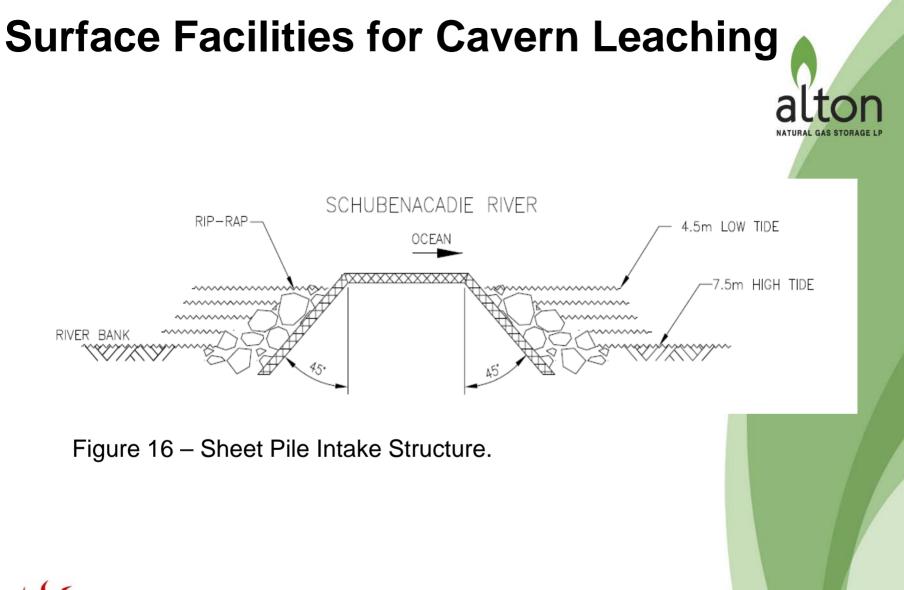


Figure 15 – Leach Water Intake



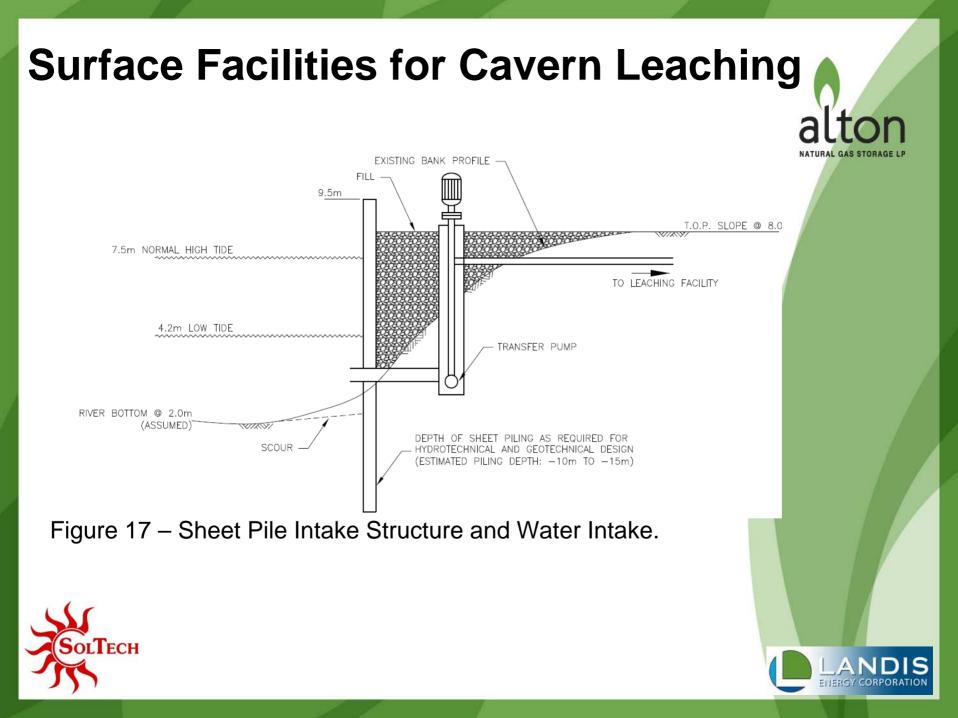


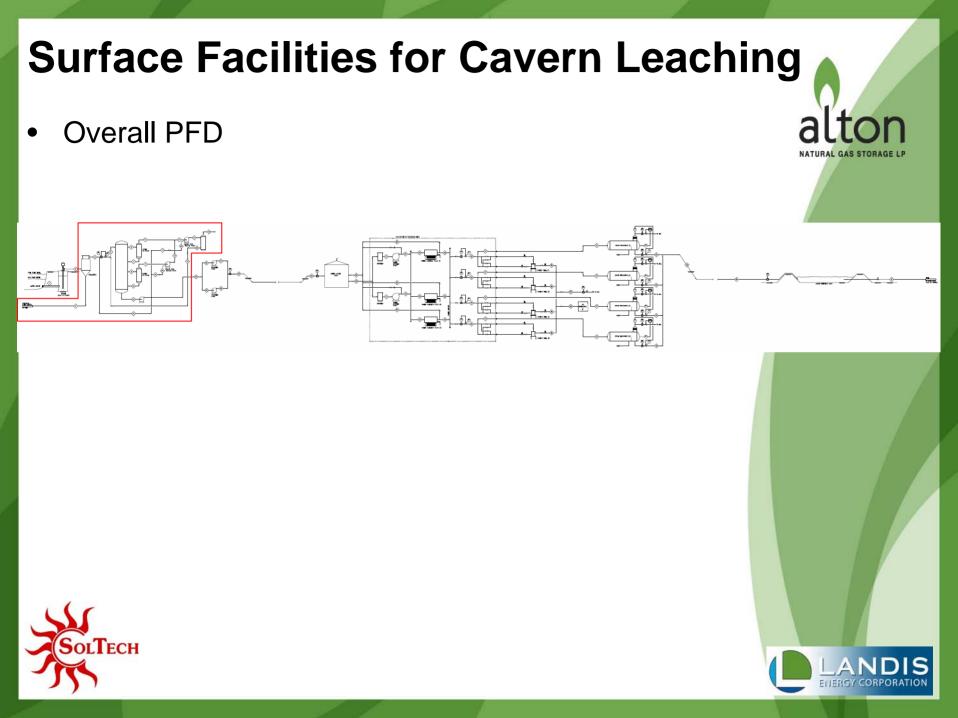
NATURAL GAS STORAG

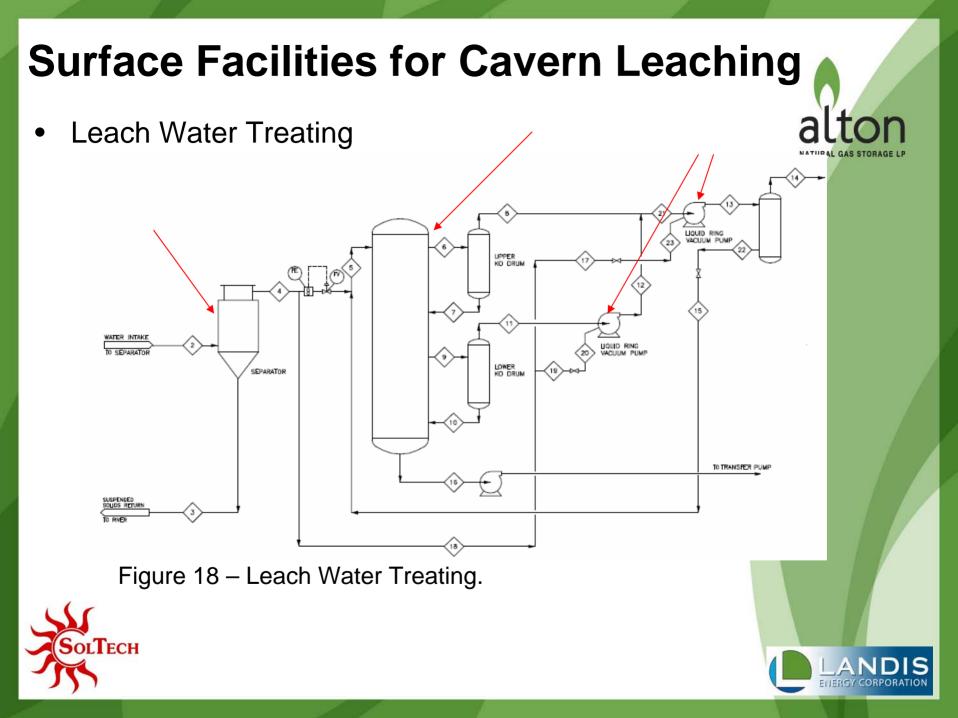


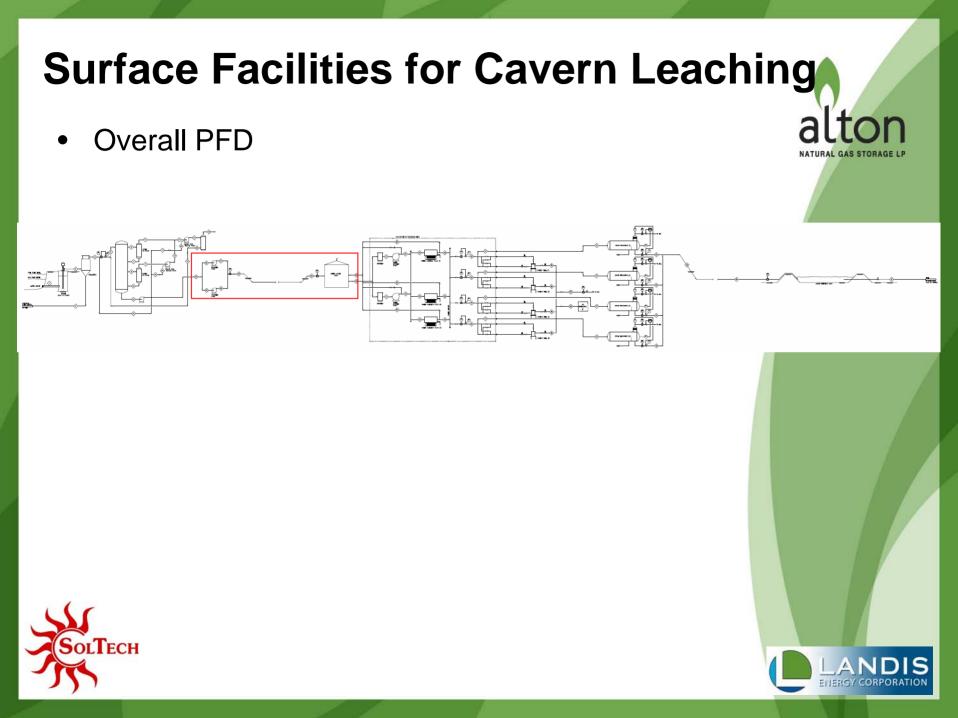












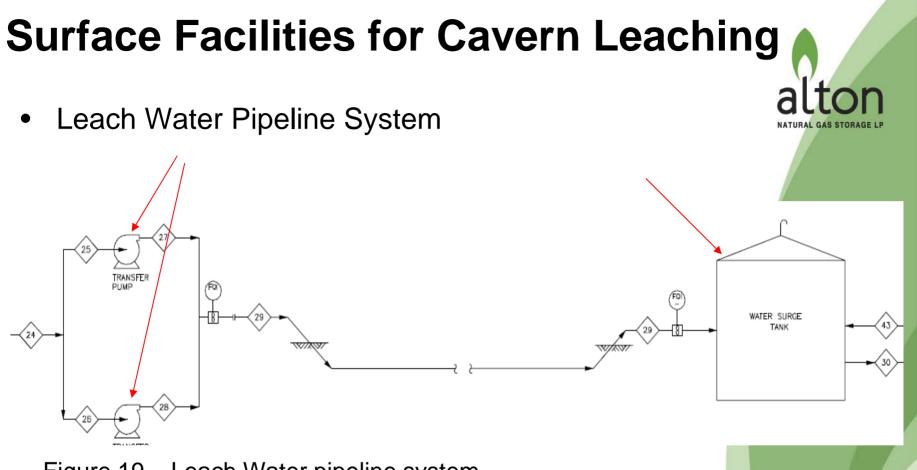
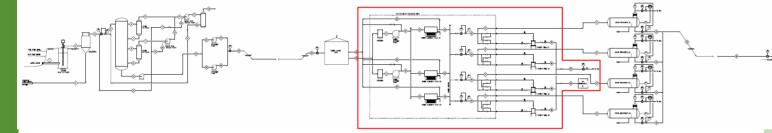


Figure 19 – Leach Water pipeline system.





Overall PFD



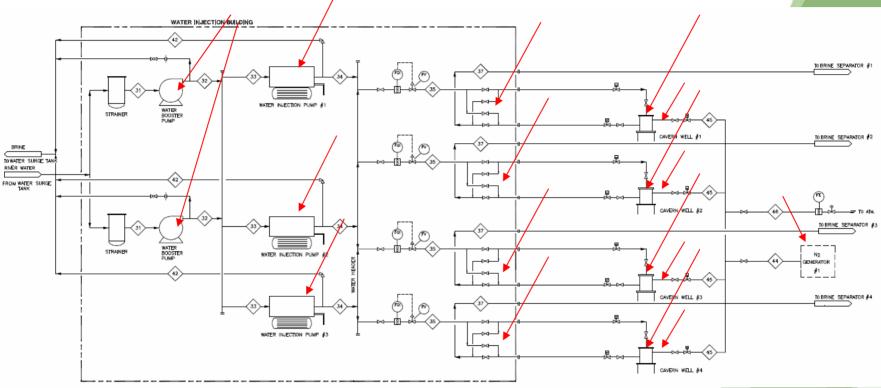




NATURAL GAS STORAGI

Surface Facilities for Cavern Leaching

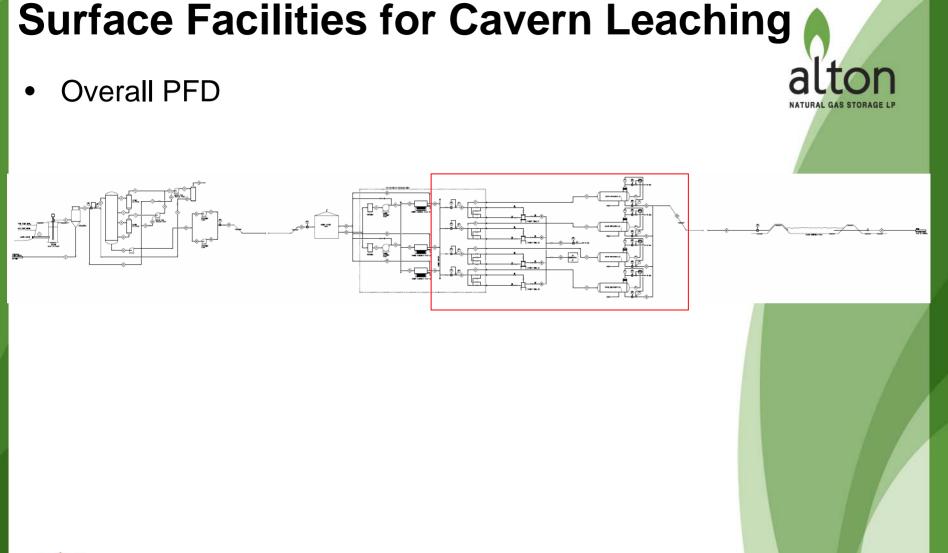
- Leach Water Handling
- Cavern Wells



NATURAL GAS STORAG

Figure 20 – Leach Water Handling.







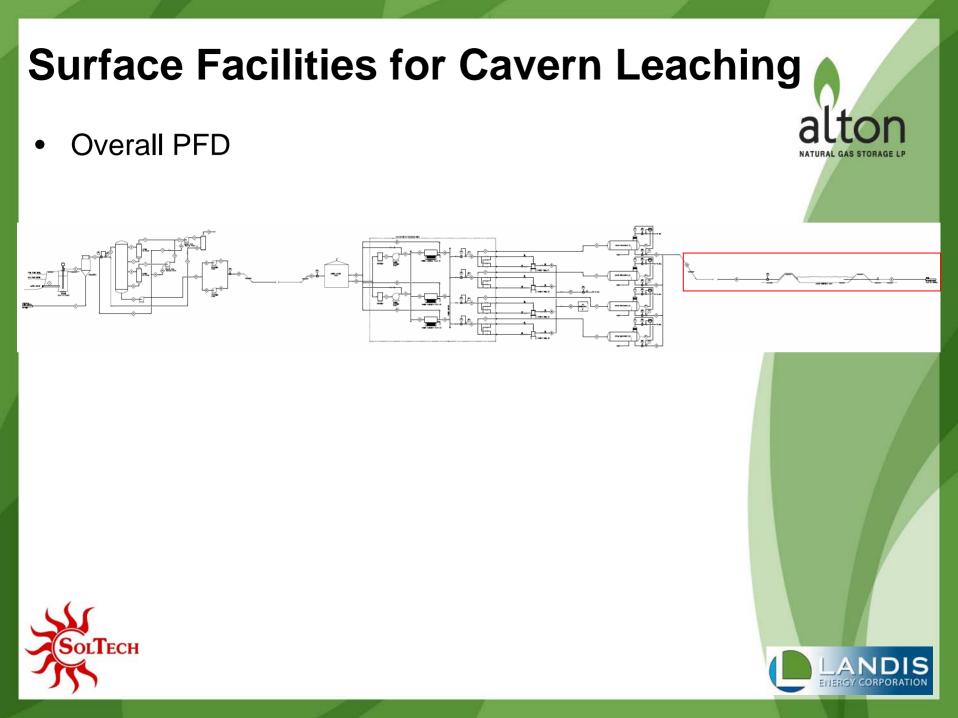


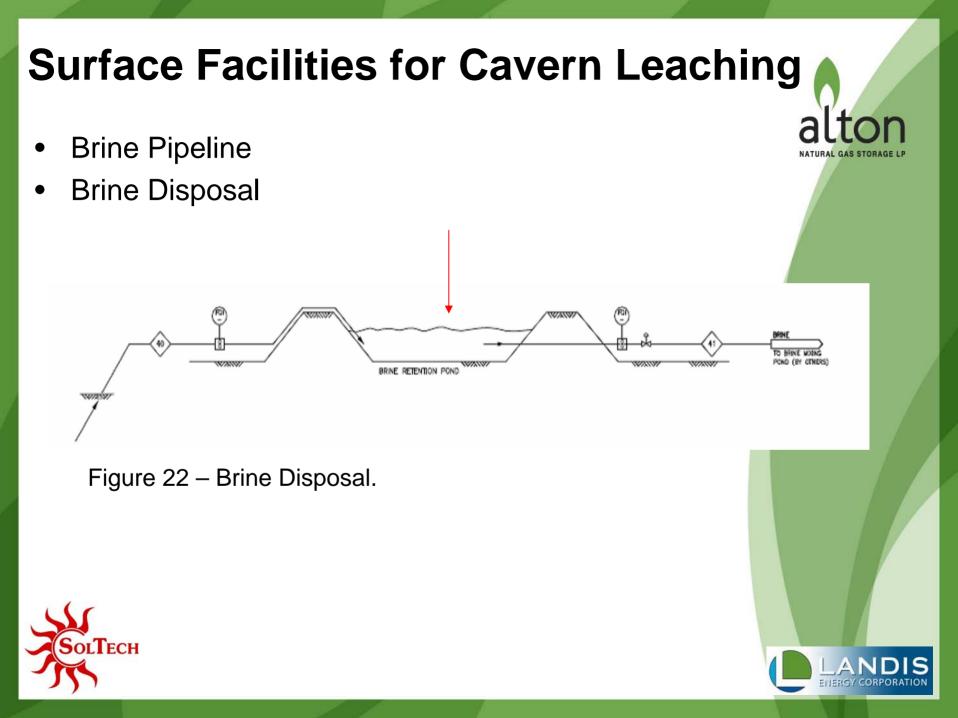
Surface Facilities for Cavern Leaching Brine Handling NATURAL GAS STORAG TER NJECTION BUILDING BRINE SEPARATOR -34 WATER INJECTION PUMP #1 Ø CAVERN WELL #1 BRINE SEPARATOR #2 BRINE RETENTION PON 8 CAVERN WELL #2 -34) WATER INJECTION PUMP #2 BRINE SEPARATOR #3 CAVERN WELL #3 WATER INJECTION PUMP #3 BRINE SEPARATOR #4 6 CANCEN WELL #4 P

Figure 21 – Brine Handling.









Surface Facilities for Gas Handling

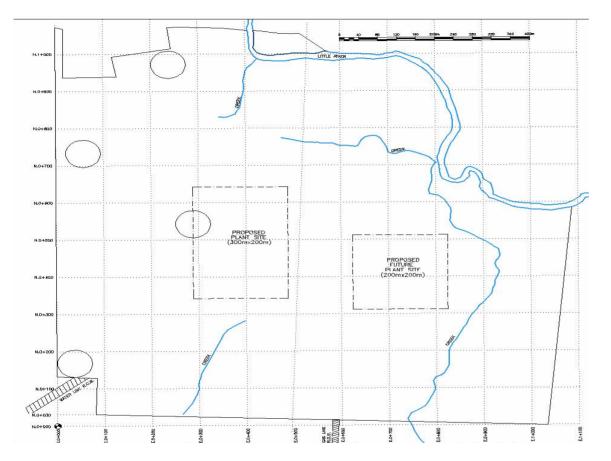


Figure 23 – Cavern Location at Proposed Site.







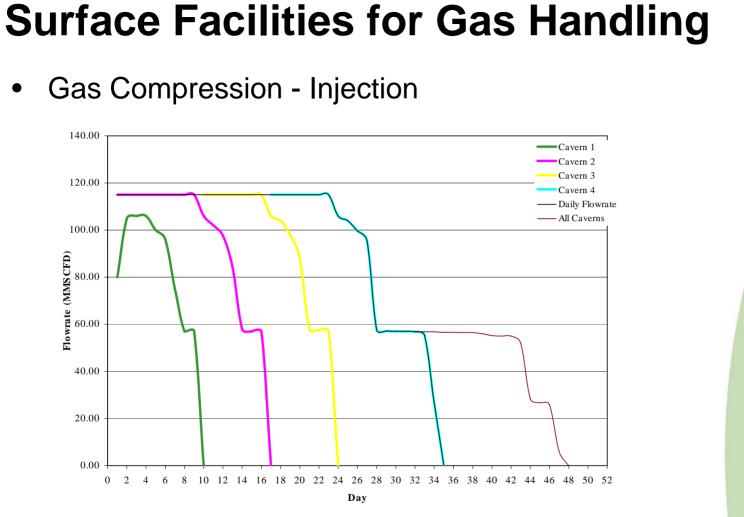


Figure 24 – Natural Gas Injection into the Caverns.





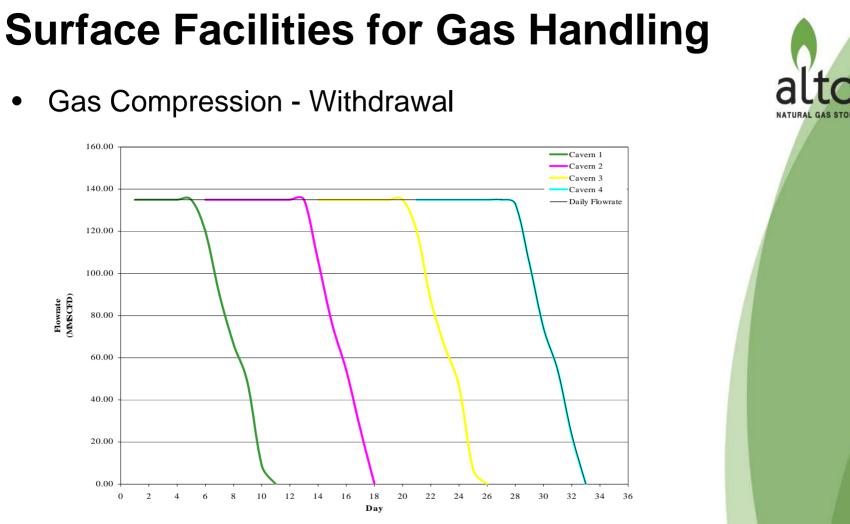


Figure 25 – Natural Gas Withdrawal from the Caverns.





Regulatory



- Cavern development will be in accordance with the requirements of the latest edition of Canadian Standards Association (CSA) Standard Z341.
- Regulatory standards are currently being prepared by the Nova Scotia Utility Regulatory Board (NSURB).





Environmental Assessment



- Application submitted for Environmental Assessment on July 6th 2007.
- The application may be viewed at <u>http://www.gov.ns.ca/enla/ea/AltonNaturalGasStorage.asp</u>.





Control and Safety

- High degree of automated control for a cavern storage project
- Control Instrumentation standards to meet or exceed CSA Z341 standards.







References

[1] Boehner, R. C. 1986. Salt and Potash Resources in Nova Scotia. Nova Scotia Department of Mines and Energy Bulletin 5, 346p.

[2] <u>http://www.mnpp.com/canada/map_page.html</u>.





