SOLIDProof

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Blockchain Security | Smart Contract Audits | KYC

MADE IN GERMANY

Lilac

Audit

Security Assessment

20. February, 2022

For

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Version	Date	Description
1.0	19. February 2022	• Layout project • Automated- /Manual-Security Testing • Summary
1.1	20. February 2022	• Mainnet Addresses changed

Network
Oasis

Website
https://lilacswap.org

Telegram
https://t.me/lilacswap

Twitter
https://twitter.com/lilacswap

Description

LilacSwap is an **Automated Marketing Making** enabled **Decentralized Finance Exchange** service and a **Yield Farming** protocol by supplying trading liquidity to the exchange, receiving interest, stake, and reinvesting them.

Project Engagement

During the 18th of February 2022, **Lilac Team** engaged Solidproof.io to audit smart contracts that they created. The engagement was technical in nature and focused on identifying security flaws in the design and implementation of the contracts. They provided Solidproof.io with access to their code repository and whitepaper.

Logo

Contract Link

v1.0

- LilacToken
  - https://explorer.emerald.oasis.dev/address/0x49FA48592Db566eE0BA3598452221F1d97aAB3aE/contracts
- LilacTimelock
  - https://explorer.emerald.oasis.dev/address/0xA18017bAEAC7a632Fd7043eF1650E2796977fA16/contracts
- LilacSwapRouter
  - https://explorer.emerald.oasis.dev/address/0x5ca7e4301C9ac05B94e4c5b0C1812015f0A0be5f/contracts
- LilacSwapFactory
  - https://explorer.emerald.oasis.dev/address/0x21c67C78E3d4B2ae7949acC62d9d384b87d74F65/contracts
- LilacGarden
  - https://explorer.emerald.oasis.dev/address/0x86a097141Ef090986137DA73c735d2055aB0D019/contracts

Vulnerability & Risk Level

Risk represents the probability that a certain source-threat will exploit vulnerability, and the impact of that event on the organization or system. Risk Level is computed based on CVSS version 3.0.

Level	Value	Vulnerability	Risk (Required Action)
Critical	9 - 10	A vulnerability that can disrupt the contract functioning in a number of scenarios, or creates a risk that the contract may be broken.	Immediate action to reduce risk level.
High	7 – 8.9	A vulnerability that affects the desired outcome when using a contract, or provides the opportunity to use a contract in an unintended way.	Implementation of corrective actions as soon aspossible.
Medium	4 – 6.9	A vulnerability that could affect the desired outcome of executing the contract in a specific scenario.	Implementation of corrective actions in a certain period.
Low	2 – 3.9	A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective.	Implementation of certain corrective actions or accepting the risk.
Informational	0 – 1.9	A vulnerability that have informational character but is not effecting any of the code.	An observation that does not determine a level of risk

Auditing Strategy and Techniques Applied

Throughout the review process, care was taken to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices. To do so, reviewed line-by-line by our team of expert pentesters and smart contract developers, documenting any issues as there were discovered.

Methodology

The auditing process follows a routine series of steps:

1. Code review that includes the following:
    i) Review of the specifications, sources, and instructions provided to SolidProof to make sure we understand the size, scope, and functionality of the smart contract.
    ii) Manual review of code, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
    iii) Comparison to specification, which is the process of checking whether the code does what the specifications, sources, and instructions provided to SolidProof describe.

2. Testing and automated analysis that includes the following:
    i) Test coverage analysis, which is the process of determining whether the test cases are actually covering the code and how much code is exercised when we run those test cases.
    ii) Symbolic execution, which is analysing a program to determine what inputs causes each part of a program to execute.

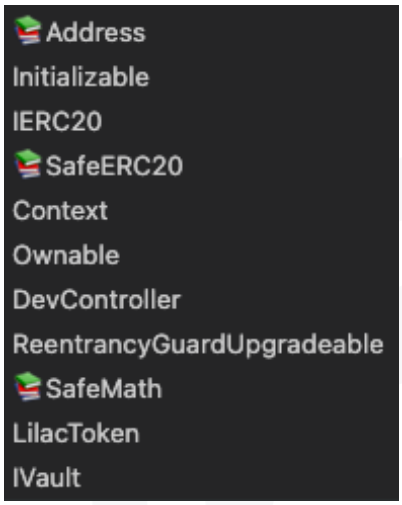
3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarify, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.

4. Specific, itemized, actionable recommendations to help you take steps to secure your smart contracts.

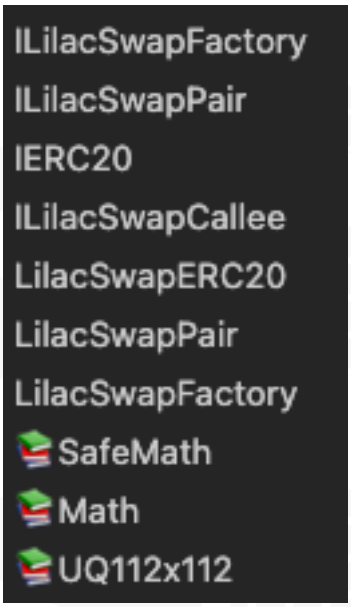
Used Code from other Frameworks/Smart Contracts (direct imports)

Imported packages:

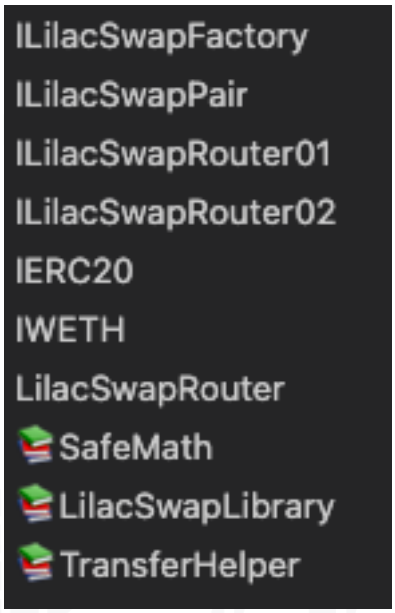
LilacGarden



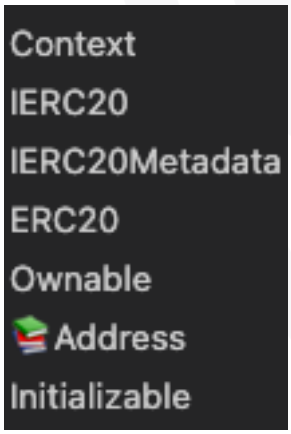
LilacSwapFactory



LilacSwapRouter



LilacToken



Tested Contract Files

This audit covered the following files listed below with a SHA-1 Hash.

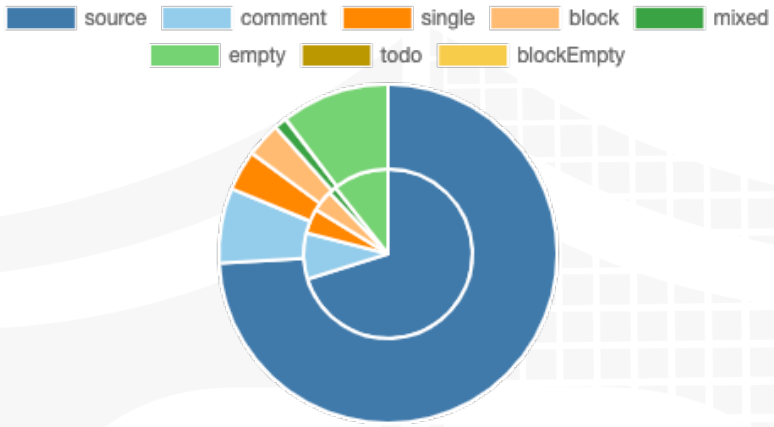
A file with a different Hash has been modified, intentionally or otherwise, after the security review. A different Hash could be (but not necessarily) an indication of a changed condition or potential vulnerability that was not within the scope of this review.

v1.0

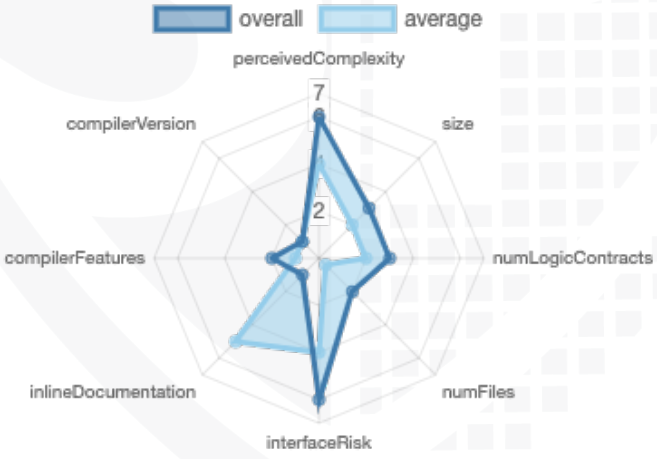
File Name	SHA-1 Hash
contracts/LilacToken.sol	82b96ba5e439079ac22718062a5fdd1f1d3fc347
contracts/LilacTimelock.sol	aed5a63ebdca3f611e18c9bb62fc75ab5956374b
contracts/LilacGarden.sol	db94b8c7632fbc56ca64c468ee7d4ae1fe710ff1
contracts/LilacSwapRouter.sol	36b80a404a03eed00df9eb23d86b9cf3f47c25be
contracts/LilacSwapFactory.sol	b705528976f5d677139a715855ec8390ad774e8e

Metrics

Source Lines
v1.0



Risk Level
v1.0



Capabilities

Components

Version	Contracts	Libraries	Interfaces	Abstract
1.0	8	11	15	8

Exposed Functions

This section lists functions that are explicitly declared public or payable. Please note that getter methods for public stateVars are not included.

Version	Public	Payable
1.0	223	12

Version	External	Internal	Private	Pure	View
1.0	166	249	8	56	87

State Variables

Version	Total	Public
1.0	66	42

Capabilities

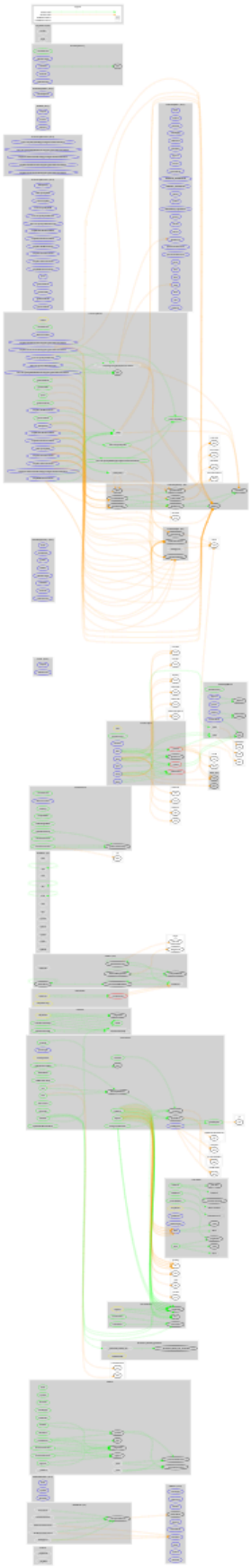
Version	Solidity Versions observed	Experimental Features	Can Receive Funds	Uses Assembly	Has Destroyable Contracts
1.0	`=0.8.12`		`yes`	`yes` (3 asm blocks)	

Version	Transfers ETH	Low-Level Calls	DelegateCall	Uses Hash Functions	EC Recover	New/ Create/ Create2
1.0	`yes`		`yes`	`yes`	`yes`	`yes → AssemblyCall:Name:create2`

Inheritance Graph

v1.0

CallGraph
v1.0



Scope of Work/Verify Claims

The above token Team provided us with the files that needs to be tested (Github, Bscscan, Etherscan, files, etc.). The scope of the audit is the main contract (usual the same name as team appended with .sol).

We will verify the following claims:

1. Correct implementation of Token standard
2. Deployer cannot mint any new tokens
3. Deployer cannot burn or lock user funds
4. Deployer cannot pause the contract
5. Overall checkup (Smart Contract Security)

Correct implementation of Token standard

Function	Description	Exist	Tested	Verified
TotalSupply	provides information about the total token supply	✓	✓	✓
BalanceOf	provides account balance of the owner's account	✓	✓	✓
Transfer	executes transfers of a specified number of tokens to a specified address	✓	✓	✓
TransferFrom	executes transfers of a specified number of tokens from a specified address	✓	✓	✓
Approve	allow a spender to withdraw a set number of tokens from a specified account	✓	✓	✓
Allowance	returns a set number of tokens from a spender to the owner	✓	✓	✓

Write functions of contract v1.0

Deployer cannot mint any new tokens

Name	Exist	Tested	Status
Deployer cannot mint	✓	✓	✗

Comments:

v1.0

- LilacToken
    - OnlyMinter can mint new tokens

Deployer cannot burn or lock user funds

Name	Exist	Tested	Status
Deployer cannot lock	✓	✓	✓
Deployer cannot burn	✓	✓	✓

Comments:

v1.0

- LilacToken
  - Everybody can burn tokens

Deployer cannot pause the contract

Name	Exist	Tested	Status
Deployer cannot pause	–	–	–

Overall checkup (Smart Contract Security)

Tested	Verified
✓	✓

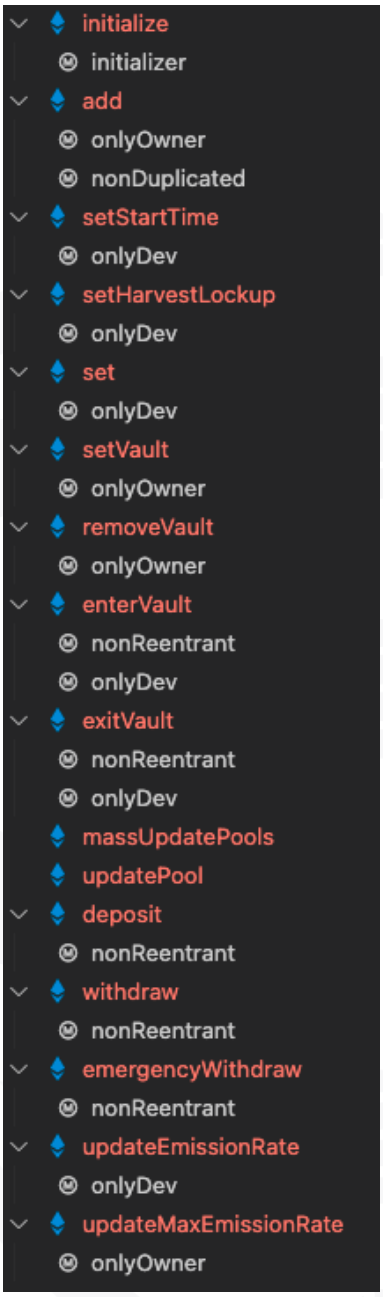
Legend

Attribute	Symbol
Verfified / Checked	✓
Partly Verified	⚑
Unverified / Not checked	✗
Not available	-

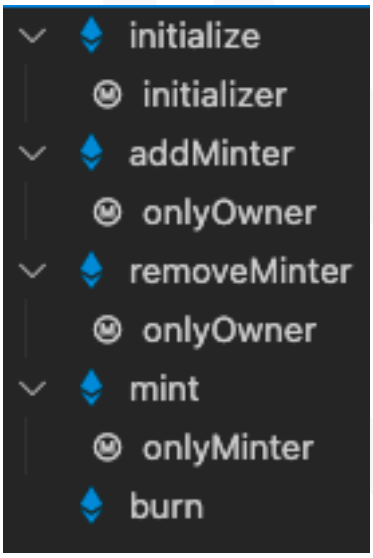
Modifiers and public functions

v1.0

LilacGarden



LilacToken



Comments

- Dev can set following state variables without any limitations
  - startTime
  - lockTime
  - poolInfo[_pid].allocPoint
  - maxLilacPerBlock
  - lilacPerBlock

- Deployer can enable/disable following state variables
  - isMinter
  - minters
  - poolExistence
  - poolInfo

- Deployer can set following addresses
  - pool.vaultToken

- Onlydev can
  - enter Vault
  - Exit Vault

Please check if an OnlyOwner or similar restrictive modifier has been forgotten.

Source Units in Scope
v1.0

Type	File	Logic Contracts	Interfaces	Lines	nLines	nSLOC	Comment Lines	Complex. Score	Capabilities
	contracts/LilacToken.sol	6	2	242	227	210	2	191	
	contracts/LilacTimelock.sol	2	———	304	292	137	109	87	
	contracts/LilacGarden.sol	9	3	603	569	492	3	412	
	contracts/LilacSwapRouter.sol	4	6	778	411	351	29	571	
	contracts/LilacSwapFactory.sol	6	4	473	398	319	47	395	
	Totals	**27**	**15**	**2400**	**1897**	**1509**	**190**	**1656**	

Legend

Attribute	Description
Lines	total lines of the source unit
nLines	normalized lines of the source unit (e.g. normalizes functions spanning multiple lines)
nSLOC	normalized source lines of code (only source-code lines; no comments, no blank lines)
Comment Lines	lines containing single or block comments
Complexity Score	a custom complexity score derived from code statements that are known to introduce code complexity (branches, loops, calls, external interfaces, ...)

Audit Results

AUDIT PASSED

Critical issues

No critical issues

High issues

No high issues

Medium issues

No medium issues

Low issues

Issue	File	Type	Line	Description
#1	Main	Contract doesn't import npm packages from source (like OpenZeppelin etc.)	-	We recommend to import all packages from npm directly without flatten the contract. Functions could be modified or can be susceptible to vulnerabilities
#2	LilacSwapFactory	Missing Zero Address Validation (missing-zero-check)	382, 407, 412, 236,	Check that the address is not zero
#3	LilacSwapRouter	Missing Zero Address Validation (missing-zero-check)	236	Check that the address is not zero
#4	LilacTimelock	Missing Zero Address Validation (missing-zero-check)	211, 273, 240	Check that the address is not zero
#5	LilacGarden	Missing Events Arithmetic	395, 601	Emit an event for critical parameter changes

#6	LilacSwapFactory	Overflow desired	See description	Value cannot overflow because you are using pragma solidity version above 0.8.x, that means that safeMath is implemented automatically in your contract. In L249 and L250 you have to use unchecked statement to overflow the value Also in L246

Informational issues

Issue	File	Type	Line	Description
#1	All	Safemath library	See description	Safemath library can be removed because its automatically implemented above pragma version 0.8.x Make sure to change every safe math operations (add, sub, etc.) to raw mathematical operations if you want to remove safe math

Commented Code exist

There are some instances of code being commented out in the following files that should be removed:

File	Line	Comment
LilacSwapRouter	757	// bytes4(keccak256(bytes('approve(address,uint256)')));
	763	// bytes4(keccak256(bytes('transfer(address,uint256)')));
	769	// bytes4(keccak256(bytes('transferFrom(address,address,uint256)')));
LilacTimelock	128	// assert(a == b * c + a % b); // There is no case in which this doesn't hold
LilaSwapFactory	102	// keccak256("Permit(address owner,address spender,uint256 value,uint256 nonce,uint256 deadline)");

Recommendation
Remove the commented code, or address them properly.

Audit Comments
We recommend you to use the special form of comments (NatSpec Format, Follow link for more information https://docs.soliditylang.org/en/v0.5.10/natspec-format.html) for your contracts to provide rich documentation for functions, return variables and more. This helps investors to make clear what that variables, functions etc. do.

19. February 2022:
- Read whole report for more information

SWC Attacks

ID	Title	Relationships	Status
SWC-136	Unencrypted Private Data On-Chain	CWE-767: Access to Critical Private Variable via Public Method	PASSED
SWC-135	Code With No Effects	CWE-1164: Irrelevant Code	PASSED
SWC-134	Message call with hardcoded gas amount	CWE-655: Improper Initialization	PASSED
SWC-133	Hash Collisions With Multiple Variable Length Arguments	CWE-294: Authentication Bypass by Capture-replay	PASSED
SWC-132	Unexpected Ether balance	CWE-667: Improper Locking	PASSED
SWC-131	Presence of unused variables	CWE-1164: Irrelevant Code	PASSED
SWC-130	Right-To-Left-Override control character (U+202E)	CWE-451: User Interface (UI) Misrepresentation of Critical Information	PASSED
SWC-129	Typographical Error	CWE-480: Use of Incorrect Operator	PASSED
SWC-128	DoS With Block Gas Limit	CWE-400: Uncontrolled Resource Consumption	PASSED

SWC-127	Arbitrary Jump with Function Type Variable	CWE-695: Use of Low-Level Functionality	PASSED
SWC-125	Incorrect Inheritance Order	CWE-696: Incorrect Behavior Order	PASSED
SWC-124	Write to Arbitrary Storage Location	CWE-123: Write-what-where Condition	PASSED
SWC-123	Requirement Violation	CWE-573: Improper Following of Specification by Caller	PASSED
SWC-122	Lack of Proper Signature Verification	CWE-345: Insufficient Verification of Data Authenticity	PASSED
SWC-121	Missing Protection against Signature Replay Attacks	CWE-347: Improper Verification of Cryptographic Signature	PASSED
SWC-120	Weak Sources of Randomness from Chain Attributes	CWE-330: Use of Insufficiently Random Values	PASSED
SWC-119	Shadowing State Variables	CWE-710: Improper Adherence to Coding Standards	PASSED
SWC-118	Incorrect Constructor Name	CWE-665: Improper Initialization	PASSED
SWC-117	Signature Malleability	CWE-347: Improper Verification of Cryptographic Signature	PASSED

SWC-116	Timestamp Dependence	CWE-829: Inclusion of Functionality from Untrusted Control Sphere	PASSED
SWC-115	Authorization through tx.origin	CWE-477: Use of Obsolete Function	PASSED
SWC-114	Transaction Order Dependence	CWE-362: Concurrent Execution using Shared Resource with Improper Synchronization ('Race Condition')	PASSED
SWC-113	DoS with Failed Call	CWE-703: Improper Check or Handling of Exceptional Conditions	PASSED
SWC-112	Delegatecall to Untrusted Callee	CWE-829: Inclusion of Functionality from Untrusted Control Sphere	PASSED
SWC-111	Use of Deprecated Solidity Functions	CWE-477: Use of Obsolete Function	PASSED
SWC-110	Assert Violation	CWE-670: Always-Incorrect Control Flow Implementation	PASSED
SWC-109	Uninitialized Storage Pointer	CWE-824: Access of Uninitialized Pointer	PASSED
SWC-108	State Variable Default Visibility	CWE-710: Improper Adherence to Coding Standards	PASSED
SWC-107	Reentrancy	CWE-841: Improper Enforcement of Behavioral Workflow	PASSED
SWC-106	Unprotected SELFDESTRUCT Instruction	CWE-284: Improper Access Control	PASSED

SWC-105	Unprotected Ether Withdrawal	CWE-284: Improper Access Control	PASSED
SWC-104	Unchecked Call Return Value	CWE-252: Unchecked Return Value	PASSED
SWC-103	Floating Pragma	CWE-664: Improper Control of a Resource Through its Lifetime	PASSED
SWC-102	Outdated Compiler Version	CWE-937: Using Components with Known Vulnerabilities	PASSED
SWC-101	Integer Overflow and Underflow	CWE-682: Incorrect Calculation	PASSED
SWC-100	Function Default Visibility	CWE-710: Improper Adherence to Coding Standards	PASSED

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