CERTIK

Code Security Assessment

WOOFi II

Feb 7th, 2022

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Disclaimer

About

Summary

This report has been prepared for WOOFi II to discover issues and vulnerabilities in the source code of the WOOFi II project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis and Manual Review techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

Overview

Project Summary

Project Name	WOOFi II
Platform	bsc
Language	Solidity
Codebase	woofi_earn_Jan_27.zip, woofi_earn_Jan_30.zip, Vault.sol
Commit	Shasum256 of the zip file: 29ed6af071345ad457e840ff829e5f32401756e8a3a814f3728f956da5fe10bf Shasum256 of the zip file: 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434 Shasum256 of Vault.sol: 3e0b032d592ab7747921503995f6b2ff31afc9d11075ee00817b81ca8486eef6

Audit Summary

Delivery Date	Feb 07, 2022
Audit Methodology	Static Analysis, Manual Review

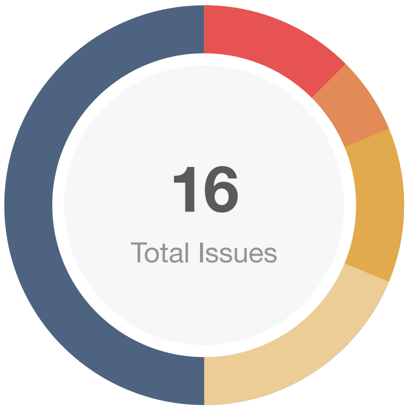
Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Mitigated	Resolved
● Critical	2	0	0	0	0	0	2
● Major	1	0	0	1	0	0	0
● Medium	2	0	0	1	0	0	1
● Minor	3	0	0	2	0	0	1
● Informational	8	0	0	3	1	0	4
● Discussion	0	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
BSW	BaseStrategy.sol	97555669c004bce4a97ee6ac946120dc627f3b2f55361918020fd7c8da310b03
SCW	StrategyCake.sol	ae4360441f5a939cccd36cbe9310ff992b6c453d5268ae53225ef87d5490480b
SLP	StrategyLP.sol	6e32b8fd74300c2e09a2e02867e3186860d8709956e6f45b52c904ad57d453e8
VWO	Vault.sol	6e5d6f1ba87d13951fecbfe4bff32a30178e94b8ab6ea11ceec2527d89b00c04

Findings



🟥	**Critical**	**2** (12.50%)
🟧	**Major**	**1** (6.25%)
🟨	**Medium**	**2** (12.50%)
🟨	**Minor**	**3** (18.75%)
🟦	**Informational**	**8** (50.00%)
🟩	**Discussion**	**0** (0.00%)

ID	Title	Category	Severity	Status
BSW-01	Missing emit events	Coding Style	● Informational	Partially Resolved
BSW-02	Lack of Input Validation	Volatile Code	● Informational	✓ Resolved
BSW-03	Fee Collectors	**Centralization / Privilege**	● **Medium**	ⓘ Acknowledged
SCW-01	Third Party Dependencies	Volatile Code	● Minor	ⓘ Acknowledged
SLP-01	Third Party Dependencies	Volatile Code	● Minor	ⓘ Acknowledged
SLP-02	Lack of Input Validation	Volatile Code	● Informational	✓ Resolved
SLP-03	Missing Error Messages	Coding Style	● Informational	✓ Resolved
SLP-04	Return value not handled	Volatile Code	● Informational	ⓘ Acknowledged
SLP-05	Wrong Path To Swap `lpToken1`	Logical Issue	● Critical	✓ Resolved
VWO-01	Address Type Could Be Indexed In Events	Language Specific	● Informational	✓ Resolved
VWO-02	Magic Numbers	Coding Style	● Informational	ⓘ Acknowledged
VWO-03	Contract Locks Ether	Logical Issue	● Medium	✓ Resolved
VWO-04	Lack Of Stop Strategy In `setupStrat`	Logical Issue	● Minor	✓ Resolved

ID	Title	Category	Severity	Status
WOO-01	Centralization Related Risks	**Centralization / Privilege**	● **Major**	ⓘ Acknowledged
WOO-02	Unknown Imported Source Files	Logical Issue	● Informational	ⓘ Acknowledged
WOO-03	Strategy not Support `WBNB`	Logical Issue	● Critical	✓ Resolved

BSW-01 | Missing Emit Events

Category	Severity	Location	Status
Coding Style	● Informational	BaseStrategy.sol (v2): 104~124	Partially Resolved

Description

There should always be events emitted in the sensitive functions that are controlled by centralization roles.

Recommendation

It is recommended emitting events for the sensitive functions that are controlled by centralization roles.

Alleviation

The development team partially resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

BSW-02 | Lack Of Input Validation

Category	Severity	Location	Status
Volatile Code	● Informational	BaseStrategy.sol (v2): 43	✓ Resolved

Description

The given input `initAccessManager` is missing the sanity checks for ensuring non-zero value.

Recommendation

We advise the client to add the following input validation:

```
require(initAccessManager != address(0), "initAccessManager is a zero address");
```

Alleviation

The development team resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

BSW-03 | Fee Collectors

Category	Severity	Location	Status
Centralization / Privilege	● **Medium**	BaseStrategy.sol (v2): 35~36	ⓘ Acknowledged

Description

There are some fee collectors, i.e. `performanceTreasury` and `withdrawalTreasury`, over time, these accounts would gain more and more fees.

Recommendation

In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or via smart-contract based accounts with enhanced security practices, f.e. Multisignature wallets.

Indicatively, here are some feasible solutions that would also mitigate the potential risk:

- Time-lock with reasonable latency, i.e. 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent single point of failure due to the private key;
- Introduction of a DAO / governance / voting module to increase transparency and user involvement.

Alleviation

No Alleviation.

SCW-01 | Third Party Dependencies

Category	Severity	Location	Status
Volatile Code	● Minor	StrategyCake.sol (v2): 19	ⓘ Acknowledged

Description

The contract is serving as the underlying entity to interact with third-party `Pancake MasterChef` protocols. The scope of the audit treats 3rd party entities as black boxes and assume their functional correctness. However, in the real world, 3rd parties can be compromised and this may lead to lost or stolen assets. In addition, upgrades of 3rd parties can possibly create severe impacts, such as increasing fees of 3rd parties, migrating to new LP pools, etc.

Recommendation

We understand that the business logic of `StrategyCake` requires interaction with `Pancake MasterChef`. We encourage the team to constantly monitor the statuses of 3rd parties to mitigate the side effects when unexpected activities are observed.

Alleviation

[Woofi]: We will keep close eye on Pancake Masterchef. And we only deal with the top-tier dex or lending platforms on BSC.

SLP-01 | Third Party Dependencies

Category	Severity	Location	Status
Volatile Code	● Minor	StrategyLP.sol (v2): 34~35	ⓘ Acknowledged

Description

The contract is serving as the underlying entity to interact with third-party `Pancake MasterChef` and `PancakeSwap` protocols. The scope of the audit treats 3rd party entities as black boxes and assume their functional correctness. However, in the real world, 3rd parties can be compromised and this may lead to lost or stolen assets. In addition, upgrades of 3rd parties can possibly create severe impacts, such as increasing fees of 3rd parties, migrating to new LP pools, etc.

Recommendation

We understand that the business logic of `StrategyLP` requires interaction with `Pancake MasterChef` and `PancakeSwap`. We encourage the team to constantly monitor the statuses of 3rd parties to mitigate the side effects when unexpected activities are observed.

Alleviation

[Woofi]: We will keep close eye on Pancake Masterchef. And we only deal with the top-tier dex or lending platforms on BSC.

SLP-02 | Lack Of Input Validation

Category	Severity	Location	Status
Volatile Code	● Informational	StrategyLP.sol (v2): 45	✓ Resolved

Description

The given input `initWant` is missing the sanity checks for ensuring non-zero value.

Recommendation

We advise the client to add the following input validation:

```
require(initWant != address(0), "initWant is a zero address");
```

Alleviation

The development team resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

SLP-03 | Missing Error Messages

Category	Severity	Location	Status
Coding Style	● Informational	StrategyLP.sol (v2): 63~64	✓ Resolved

Description

The **require** can be used to check for conditions and throw an exception if the condition is not met. It is better to provide a string message containing details about the error that will be passed back to the caller.

Recommendation

We advise adding error messages to the linked **require** statements.

Alleviation

The development team resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

SLP-04 | Return Value Not Handled

Category	Severity	Location	Status
Volatile Code	● Informational	StrategyLP.sol (v2): 155	ⓘ Acknowledged

Description

The return value of function `addLiquidity` is not properly handled.

```
IPancakeRouter(uniRouter).addLiquidity(lpToken0, lpToken1, lp0Balance, lp1Balance, 0, 0,
address(this), now);
```

Recommendation

We recommend using variables to receive the return value of the functions mentioned above and handle both success and failure cases if needed by the business logic.

Alleviation

[Woofi]:double-checked the pancake router interface and https://docs.uniswap.org/protocol/V2/reference/smart-contracts/router-01 , we don't need to check the return value here. If anything wrong, the tx just got reverted; or there's no LP for us to deposit for farming.

SLP-05 | Wrong Path To Swap `lpToken1`

Category	Severity	Location	Status
Logical Issue	● Critical	StrategyLP.sol (v2): 150	✓ Resolved

Description

```
if (lpToken1 != reward) {
    IPancakeRouter(uniRouter).swapExactTokensForTokens(rewardHalf, 0, rewardToLP0Route,
address(this), now);
}
```

The above code wants to swap reward to `lpToken1`, but it uses `rewardToLP0Route` as the swap path.

Recommendation

Consider changing the values of the `path` to `rewardToLP1Route`:

```
if (lpToken1 != reward) {
    IPancakeRouter(uniRouter).swapExactTokensForTokens(rewardHalf, 0, rewardToLP1Route,
address(this), now);
}
```

Alleviation

The development team resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

VWO-01 | Address Type Could Be Indexed In Events

Category	Severity	Location	Status
Language Specific	● Informational	Vault.sol (v2): 35~36	Resolved

Description

It is recommended to add `indexed` keyword for parameters in events, which makes it easier for users to navigate event logs.

Recommendation

We advise the client to add keyword `indexed` in the declaration of events.

```
event NewStratCandidate(address indexed implementation);
event UpgradeStrat(address indexed implementation);
```

Alleviation

The development team resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

VWO-02 | Magic Numbers

Category	Severity	Location	Status
Coding Style	● Informational	Vault.sol (v2): 178	ⓘ Acknowledged

Description

The linked magic numbers should be set as `constant` and `internal` contract-level variables with a self-explanatory variable name as well as accompanying comments when necessary. This type of declaration is functionally equivalent to the current implementation as `constant` variables that are `internal` or `private` are simply replaced in the codebase with their literal value.

```
stratCandidate.proposedTime = 5000000000;
```

Recommendation

We advise the team adds proper documentation specifying the purpose of the linked numbers.

Alleviation

[Woofi]:This number set is from the code from BeefyFinance, not defining the const value to save the gas.

VWO-03 | Contract Locks Ether

Category	Severity	Location	Status
Logical Issue	● Medium	Vault.sol (v2): 193	✓ Resolved

Description

The contract has payable fallback functions but without a withdrawal capacity. Hence every Ether sent to the contract will be lost.

Recommendation

We advise rewriting the functions to avoid loss of Ether or adding an ether withdrawal feature. An example:

```
    function withdraw(address account) external onlyAdmin {
        payable(account).transfer(address(this).balance);
    }
```

Alleviation

The development team resolved this issue in a single source file which shasum is 3e0b032d592ab7747921503995f6b2ff31afc9d11075ee00817b81ca8486eef6.

VWO-04 | Lack Of Stop Strategy In `setupStrat`

Category	Severity	Location	Status
Logical Issue	● Minor	Vault.sol (v2): 156~160	✓ Resolved

Description

In `setupStrat` function, the old strategy should be stopped before it is updated. Otherwise, all the tokens deposited in the old strategy will not be returned back to the vault contract.

Recommendation

Consider stopping the old strategy before it is updated and depositing all tokens to the new strategy:

```
function setupStrat(address _strat) public onlyAdmin {
    require(_strat != address(0), 'Vault: STRAT_ALREADY_SET');
    require(address(this) == IStrategy(_strat).vault(), 'Vault: STRAT_VAULT_INVALID');
    strategy.retireStrat();
    strategy = IStrategy(_strat);
    earn();
}
```

Alleviation

The development team resolved this issue in zip source files which shasum is 1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

WOO-01 | Centralization Related Risks

Category	Severity	Location	Status
Centralization / Privilege	● Major	BaseStrategy.sol (v2): 104~136, 53~58 StrategyCake.sol (v2): 28~57, 81~96 StrategyLP.sol (v2): 74~105, 158~173 Vault.sol (v2): 156~191	ⓘ Acknowledged

Description

In the contract `BaseStrategy`, the role `_owner` and `vaultAdmin` have authority over the following functions:

- `setPerformanceFee(uint256 fee)`
- `setWithdrawalFee(uint256 fee)`
- `setPerformanceTreasury(address treasury)`
- `setWithdrawalTreasury(address treasury)`
- `setHarvestOnDeposit(bool newHarvestOnDeposit)`
- `pause()`
- `unpause()`

Any compromise to the `_owner` or `vaultAdmin` account may allow a hacker to take advantage of this authority.

In the contract `BaseStrategy`, the role `vault` has authority over the following functions:

- `beforeDeposit()`

Any compromise to the `vault` account may allow a hacker to take advantage of this authority.

In the contract `StrategyCake`, the role `_owner` and `vaultAdmin` have authority over the following functions:

- `emergencyExit()`

Any compromise to the `_owner` or `vaultAdmin` account may allow a hacker to take advantage of this authority.

In the contract `StrategyCake`, the role `vault` has authority over the following functions:

- `retireStrat()`

- `withdraw(uint256 amount)`
- `harvest()`

Any compromise to the `vault` account may allow a hacker to take advantage of this authority.

In the contract `StrategyLP`, the role `_owner` and `vaultAdmin` have authority over the following functions:

- `emergencyExit()`

Any compromise to the `_owner` or `vaultAdmin` account may allow a hacker to take advantage of this authority.

In the contract `StrategyLP`, the role `vault` has authority over the following functions:

- `retireStrat()`
- `withdraw(uint256 amount)`
- `harvest()`

Any compromise to the `vault` account may allow a hacker to take advantage of this authority.

In the contract `Vault`, the role `_owner` and `vaultAdmin` have authority over the following functions:

- `setupStrat(address _strat)`
- `proposeStrat(address _implementation)`
- `upgradeStrat()`
- `inCaseTokensGetStuck(address stuckToken)`

Any compromise to the `_owner` or `vaultAdmin` account may allow a hacker to take advantage of this authority.

Recommendation

The risk describes the current project design and potentially makes iterations to improve in the security operation and level of decentralization, which in most cases cannot be resolved entirely at the present stage. We advise the client to carefully manage the privileged account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., multi-signature wallets.

Indicatively, here are some feasible suggestions that would also mitigate the potential risk at a different level in terms of short-term, long-term and permanent:

Short Term:

Timelock and Multi sign (⅔, ⅗) combination *mitigate* by delaying the sensitive operation and avoiding a single point of key management failure.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key compromised;
  AND
- A medium/blog link for sharing the timelock contract and multi-signers addresses information with the public audience.

Long Term:

Timelock and DAO, the combination, *mitigate* by applying decentralization and transparency.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Introduction of a DAO/governance/voting module to increase transparency and user involvement;
  AND
- A medium/blog link for sharing the timelock contract, multi-signers addresses, and DAO information with the public audience.

Permanent:

Renouncing the ownership or removing the function can be considered *fully resolved*.

- Renounce the ownership and never claim back the privileged roles;
  OR
- Remove the risky functionality.

Noted: Recommend considering the long-term solution or the permanent solution. The project team shall make a decision based on the current state of their project, timeline, and project resources.

Alleviation

[Woofi]: The owner and access manager will be a 3/5 multi-sig wallet by Gnosis Safe.

WOO-02 | Unknown Imported Source Files

Category	Severity	Location	Status
Logical Issue	● Informational	Vault.sol (v2): 4~14 StrategyLP.sol (v2): 4~16 StrategyCake.sol (v2): 4~9 BaseStrategy.sol (v2): 4~13	ⓘ Acknowledged

Description

The aforementioned imported files are unknown.

Recommendation

These unknown imported files are out of audit scope.

Alleviation

[WOOFi Team]: Openzepplin imports.

WOO-03 | Strategy Not Support `WBNB`

Category	Severity	Location	Status
Logical Issue	● Critical	Vault.sol (v2): 156~160, 169~173, 85~86 StrategyLP.sol (v2): 45~69, 33 StrategyCake.sol (v2): 22	✓ Resolved

Description

The strategy contract `StrategyCake` only supports the `Cake` token, the strategy contract `StrategyLP` supports the `Cake` token and lp-style tokens. Since both of the two contracts do not support `WBNB`, if the principal token `want` in `Vault` is `WBNB` and any strategy is activated, all the `WBNB` tokens will be deposited into the strategy contract and lost forever.

This incident will happen in any other token which is not `Cake` token or `lp` token which is not in `Pancake` Farm.

Recommendation

We advise the client to consider the following workarounds.

- **Case 1**: The `want` is `WBNB`.

Deactivate the strategy. All the WBNBs will be stored in the `Vault` contract account.

- **Case 2**: The `want` is any other token.

Check whether the `want` token of `Vault` equals the `want` token of the strategy contract or not in the function `setupStrat` and `upgradeStrat`. An example.

```
    function setupStrat(address _strat) public onlyAdmin {
        require(_strat != address(0), 'Vault: STRAT_ALREADY_SET');
        require(address(this) == IStrategy(_strat).vault(), 'Vault:
STRAT_VAULT_INVALID');
        require(address(want) == IStrategy(_strat).want(), 'Vault: TOKEN_VAULT_INVALID');
        strategy = IStrategy(_strat);
    }
    //...
    function upgradeStrat() public onlyAdmin {
        require(stratCandidate.implementation != address(0), 'Vault: NO_CANDIDATE');
        require(stratCandidate.proposedTime.add(48 hours) < block.timestamp, 'Vault:
TIME_INVALID');
```

```
        require(address(want) == IStrategy(stratCandidate.implementation).want(), 'Vault:
TOKEN_VAULT_INVALID');
        //....
    }
```

Alleviation

The development team resolved this issue in zip source files which shasum is
1eea647cbb41b0a63827befda410ec1ed8b36d83ebad9b99f0eb27a5bc73b434.

Appendix

Finding Categories

Centralization / Privilege

Centralization / Privilege findings refer to either feature logic or implementation of components that act against the nature of decentralization, such as explicit ownership or specialized access roles in combination with a mechanism to relocate funds.

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Language Specific

Language Specific findings are issues that would only arise within Solidity, i.e. incorrect usage of private or delete.

Coding Style

Coding Style findings usually do not affect the generated byte-code but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

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