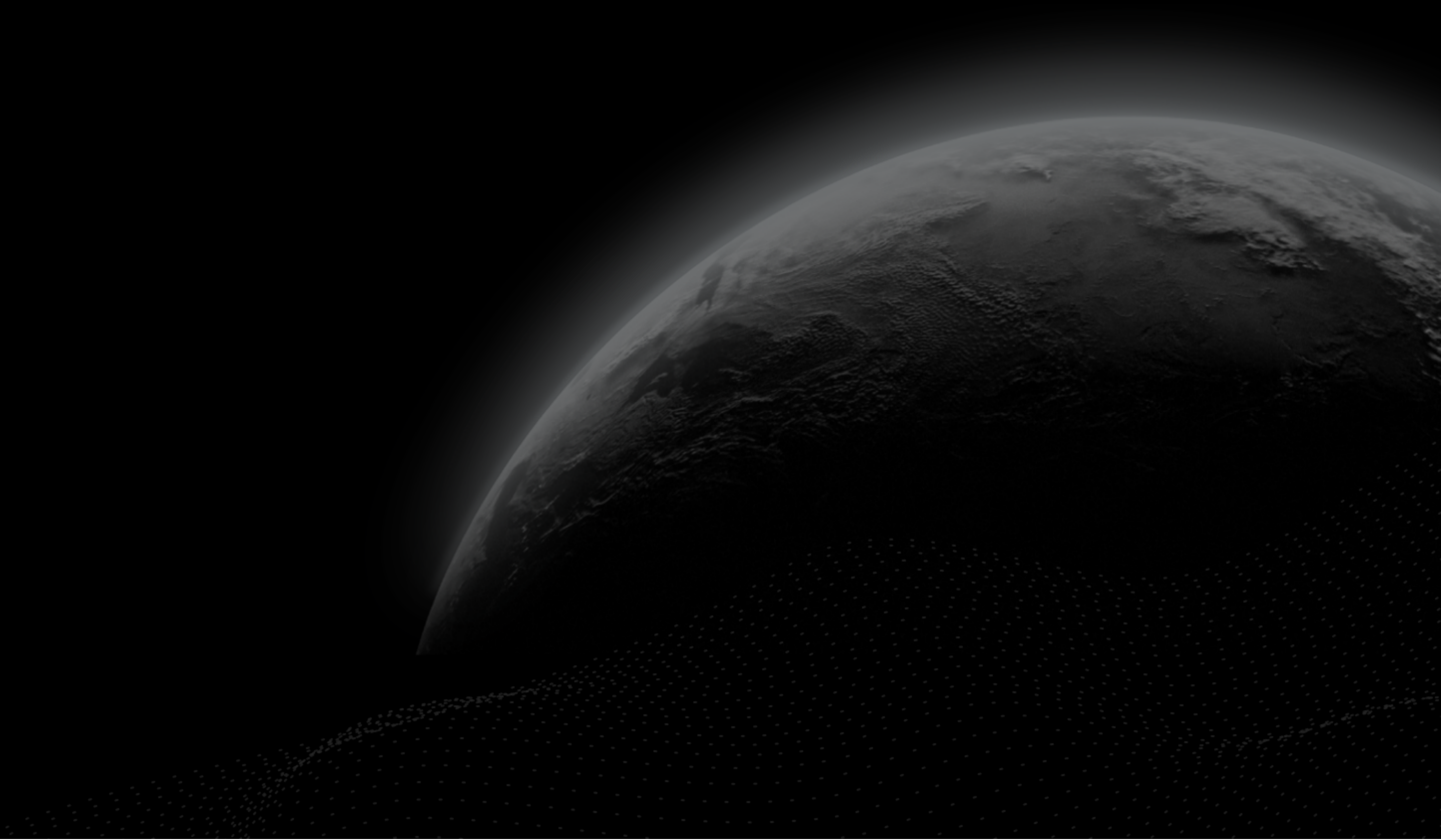
Security Assessment

# Venus - Unlist Market & Borrow Cap

CertiK Assessed on Apr 9th, 2024



CertiK Assessed on Apr 9th, 2024

# Venus - Unlist Market & Borrow Cap

The security assessment was prepared by CertiK, the leader in Web3.0 security.

## Executive Summary

TYPES
DeFi

ECOSYSTEM
Binance Smart Chain (BSC)

METHODS
Manual Review, Static Analysis

LANGUAGE
Solidity

TIMELINE
Delivered on 04/09/2024

KEY COMPONENTS
N/A

CODEBASE
https://github.com/VenusProtocol/isolated-pools
https://github.com/VenusProtocol/venus-protocol
View All in Codebase Page

COMMITS
PR-349 base: 0b3a26bb23a359af6435f3d3b95a116bd1301a88
PR-438 base: 935292415bc22f79163581858c083a117f1743d3
PR-429 base: abb29cec0a15ae247f4846f4e2e5d47f2f139e88
View All in Codebase Page

## Vulnerability Summary

| Total Findings | Resolved | Mitigated | Partially Resolved | Acknowledged | Declined |
|---|---|---|---|---|---|
| 5 | 3 | 1 | 0 | 1 | 0 |

| | | | | |
|---|---|---|---|---|
| 🟥 | 0 | Critical | | Critical risks are those that impact the safe functioning of a platform and must be addressed before launch. Users should not invest in any project with outstanding critical risks. |
| 🟧 | 1 | Major | 1 Mitigated | Major risks can include centralization issues and logical errors. Under specific circumstances, these major risks can lead to loss of funds and/or control of the project. |
| 🟨 | 0 | Medium | | Medium risks may not pose a direct risk to users' funds, but they can affect the overall functioning of a platform. |
| 🟨 | 1 | Minor | 1 Acknowledged | Minor risks can be any of the above, but on a smaller scale. They generally do not compromise the overall integrity of the project, but they may be less efficient than other solutions. |
| 🟦 | 3 | Informational | 3 Resolved | Informational errors are often recommendations to improve the style of the code or certain operations to fall within industry best practices. They usually do not affect the overall functioning of the code. |

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# CODEBASE | VENUS - UNLIST MARKET & BORROW CAP

## Repository

https://github.com/VenusProtocol/isolated-pools

https://github.com/VenusProtocol/venus-protocol

## Commit

PR-349 base: 0b3a26bb23a359af6435f3d3b95a116bd1301a88

PR-438 base: 935292415bc22f79163581858c083a117f1743d3

PR-429 base: abb29cec0a15ae247f4846f4e2e5d47f2f139e88

PR-349 update 1: 144cb9761cc3da4215dda2240b68d939c2e586f7

PR-438 update 1: 086c073fa31df3cf34971b255843dff6232e8dd7

PR-429 update 1: 36ee37bd94b291a66685e633bba5c5136ce03a3c

# AUDIT SCOPE | VENUS - UNLIST MARKET & BORROW CAP

4 files audited ● 1 file with Acknowledged findings ● 1 file with Mitigated findings ● 1 file with Resolved findings

● 1 file without findings

| ID | Repo | File | SHA256 Checksum |
|---|---|---|---|
| ● CVP | VenusProtocol/isolated-pools | contracts/Comptroller.sol | eb69b991ff5e0378d3d7ceaed9de6d6df898b0bd3f3ae12fb80159255e56ab4e |
| ● MFD | VenusProtocol/venus-protocol | contracts/Comptroller/Diamond/facets/MarketFacet.sol | e8f585f0e7e036487492e19d4879b88bd48ee63ad483034931261f835558b489 |
| ● PFD | VenusProtocol/venus-protocol | contracts/Comptroller/Diamond/facets/PolicyFacet.sol | 0dafbe836692140fd32160941ce531ef64a96586d70657a3c993e381902a89cb |
| ● SFD | VenusProtocol/venus-protocol | contracts/Comptroller/Diamond/facets/SetterFacet.sol | 9e8986d8ca6b1c621b9db3a64e05a085c2c0efa43c3c94c7120c6f1fd7c3fd86 |

# APPROACH & METHODS

## VENUS - UNLIST MARKET & BORROW CAP

This report has been prepared for Venus to discover issues and vulnerabilities in the source code of the Venus - Unlist Market & Borrow Cap project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Manual Review and Static Analysis 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:

- Testing the smart contracts against both common and uncommon attack vectors;
- 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.

# SUMMARY | VENUS - UNLIST MARKET & BORROW CAP

This audit concerns the changes made in files outlined in:

- PR-429 until commit abb29cec0a15ae247f4846f4e2e5d47f2f139e88;
- PR-349 until commit 0b3a26bb23a359af6435f3d3b95a116bd1301a88;
- PR-438 until commit 935292415bc22f79163581858c083a117f1743d3.

PR-429 and PR-349 are designed to add functionality to unlist a market in the Venus-Protocol and Isolated-Pools respectively. Such an operation can only be performed if actions are paused, the borrow and supply caps are set to zero, and the collateral factor are set to zero.

PR-438 is designed to update how the protocol handles when the borrow cap is 0. Previously a borrow cap of 0 corresponded to unlimited borrowing, where this PR changes this behavior so that a borrow cap of 0 corresponds to borrowing being disallowed.

Note that any centralization risks present in the existing codebase before these PRs were not considered in this audit and only those added in these PRs are addressed in the audit. We recommend all users carefully review the centralization risks, much of which can be found in our previous audits which can be found here: https://skynet.certik.com/projects/venus.

# FINDINGS | VENUS - UNLIST MARKET & BORROW CAP

| | | | | | |
|---|---|---|---|---|---|
| 5 | 0 | 1 | 0 | 1 | 3 |
| Total Findings | Critical | Major | Medium | Minor | Informational |

This report has been prepared to discover issues and vulnerabilities for Venus - Unlist Market & Borrow Cap. Through this audit, we have uncovered 5 issues ranging from different severity levels. Utilizing the techniques of Manual Review & Static Analysis to complement rigorous manual code reviews, we discovered the following findings:

| ID | Title | Category | Severity | Status |
|---|---|---|---|---|
| **VPB-02** | **Centralization Related Risks** | **Centralization** | **Major** | ● **Mitigated** |
| CVP-02 | File Allows Solidity Version That Is Susceptible To An Assembly Optimizer Bug | Language Version | Minor | ● Acknowledged |
| VPB-01 | Missing Checks When Unlisting Market | Design Issue | Informational | ● Resolved |
| VPB-04 | Discrepancy Between Use Of Borrow Cap In Core Vs. Isolated Pools | Coding Style | Informational | ● Resolved |
| VPB-05 | Typos And Inconsistencies | Inconsistency | Informational | ● Resolved |

# VPB-02 | CENTRALIZATION RELATED RISKS

| Category | Severity | Location | Status |
|---|---|---|---|
| **Centralization** | ● **Major** | **contracts/Comptroller.sol (PR349-Base): 211~212; contracts/Comptroller/Diamond/facets/MarketFacet.sol (PR429-Base): 142~143** | ● **Mitigated** |

## Description

Note that any centralization risks present in the existing codebase before the PR's in scope of this audit were not considered. Only those added to the in-scope PRs are addressed. We recommend all users carefully review the centralization risks, much of which can be found in our previous audits, which can be found here: https://skynet.certik.com/projects/venus.

### PR429 MarketFacet

In the contract `MarketFacet` the `DEFAULT_ADMIN_ROLE` of the `AccessControlManager` can grant addresses the privilege to call the function `unlistMarket()` . Any compromise to the `DEFAULT_ADMIN_ROLE` or accounts granted this privilege may allow the hacker to take advantage of this authority and unlist legitimate markets, only if they also have control over pausing all necessary action states and updating borrow caps, supply caps, and collateral factors to 0.

### PR349 Comptroller

In the contract `Comptroller` , the `DEFAULT_ADMIN_ROLE` of the `AccessControlManager` can grant addresses the privilege to call the function `unlistMarket()` . Any compromise to the `DEFAULT_ADMIN_ROLE` or accounts granted this privilege may allow the hacker to take advantage of this authority and unlist legitimate markets, only if they also have control over pausing all necessary action states and updating borrow caps, supply caps, and collateral factors to 0.

## 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., multisignature 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.

## Alleviation

`[Venus, 03/21/2024]` : "In both cases, we'll use the AccessControlManager (ACM) deployed at 0x4788629abc6cfca10f9f969efdeaa1cf70c23555.

In this ACM, only 0x939bd8d64c0a9583a7dcea9933f7b21697ab6396 (Normal Timelock) has the DEFAULT_ADMIN_ROLE. And this contract is a Timelock contract used during the Venus Improvement Proposals."

# CVP-02 | FILE ALLOWS SOLIDITY VERSION THAT IS SUSCEPTIBLE TO AN ASSEMBLY OPTIMIZER BUG

| Category | Severity | Location | Status |
|---|---|---|---|
| Language Version | ● Minor | contracts/Comptroller.sol (PR349-Base): 1384~1385 | ● Acknowledged |

## Description

In solidity versions 0.8.13 and 0.8.14, there is an optimizer bug where, if the use of a variable is in a separate `assembly` block from the block in which it was stored, the `mstore` operation is optimized out, leading to uninitialized memory. The code currently does not have such a pattern of execution, but it does use `mstore` s in `assembly` blocks, so it is a risk for future changes.

## Recommendation

We recommend ensuring that this bug is not introduced in future changes, by either ensuring it in your workflow or changing to a solidity version where this bug does not exist.

## Alleviation

`[Venus, 03/19/2024]` : "Issue acknowledged. I won't make any changes for the current version."

# VPB-01 | MISSING CHECKS WHEN UNLISTING MARKET

| Category | Severity | Location | Status |
|---|---|---|---|
| Design Issue | ● Informational | contracts/Comptroller.sol (PR349-Base): 220~225; contracts/Comptroller/Diamond/facets/MarketFacet.sol (PR429-Base): 151~156 | ● Resolved |

## Description

The possible actions to pause within a Comptroller are:

```
enum Action {
    MINT,
    REDEEM,
    BORROW,
    REPAY,
    SEIZE,
    LIQUIDATE,
    TRANSFER,
    ENTER_MARKET,
    EXIT_MARKET
}
```

When a market is unlisted, it is only ensured that the actions of `BORROW` , `MINT` , `REDEEM` , `REPAY` , `ENTER_MARKET` , and `LIQUIDATE` have been paused. It is not checked that the actions of `SEIZE` , `TRANSFER` , or `EXIT_MARKET` have been paused, even though these actions should still be paused. As a consequence, these three actions will be available for continued use, right up until a market has been unlisted, even if all other actions have been paused. For example, a seizure may still be initiated by another listed market.

Could you please provide more information on the decision to exclude these actions from being confirmed to be paused before unlisting the market? This allows such actions to never be set to paused, even after a market is unlisted, although the three actions would still be disabled from other checks made.

## Recommendation

We recommend providing more information on the decision to exclude these actions from being confirmed to be paused before unlisting the market. This allows such actions to never be set to paused, even after a market is unlisted, although the three actions would still be disabled from other checks made.

## Alleviation

`[CertiK, 03/21/2024]` : The client made changes resolving the finding in commits 144cb9761cc3da4215dda2240b68d939c2e586f7 and 36ee37bd94b291a66685e633bba5c5136ce03a3c.

# VPB-04 | DISCREPANCY BETWEEN USE OF BORROW CAP IN CORE VS. ISOLATED POOLS

| Category | Severity | Location | Status |
|---|---|---|---|
| Coding Style | ● Informational | contracts/Comptroller.sol (PR349-Base): 517~519; contracts/Comptroller/Diamond/facets/PolicyFacet.sol (PR438-Base): 134~135 | ● Resolved |

## Description

There is a difference in how the borrow cap is used between the Isolated Pools Comptroller and the Core pool Comptroller.

In the Isolated Pools Comptroller, the function `preBorrowHook()` requires that `nextTotalBorrows` is less or equal to the `borrowCap` . Within the Core pool Comptroller, function `borrowAllowed()` requires that `nextTotalBorrows` is strictly less than the `borrowCap` .

## Recommendation

We recommend reviewing the discrepancy and deciding whether one of the codebases should be updated to be consistent with the other.

## Alleviation

`[CertiK, 03/21/2024]` : The client made changes resolving the finding in commit f283bd3712f6bd38e0d753f55706b5e481da4161.

# VPB-05 | TYPOS AND INCONSISTENCIES

| Category | Severity | Location | Status |
|---|---|---|---|
| Inconsistency | ● Informational | contracts/Comptroller.sol (PR349-Base): 206, 207; contracts/Comptroller/ComptrollerStorage.sol (PR438-Base): 185; contracts/Comptroller/Diamond/facets/MarketFacet.sol (PR429-Base): 137 | ● Resolved |

## Description

### PR-429 MarketFacet

- In the comments above `unlistMarket()` it has "Unlist an market" instead of "Unlist a market".

### PR-349 Comptroller

- In the comments above `unlistMarket()` it has "Unlist an market" instead of "Unlist a market".
- In the comments above `unlistMarket()` it has "@dev Pauses all actions, sets borrow/supply caps to 0 and sets collateral factor to 0." However, the function checks these and does not set them.

### PR4-39 ComptrollerStorage

- The comments above `borrowCaps` states "Defaults to zero which corresponds to unlimited borrowing.", however, the functionality has changed so that zero corresponds to borrowing being disallowed.

## Recommendation

We recommend fixing the typos and inconsistencies mentioned above.

## Alleviation

`[CertiK, 03/21/2024]` : The client made changes resolving the finding in commits

- f038e3edbfae79b2c5fa9eafbf8f7f2b1767cec7
- 52236a321e8be625f9aeb14568c1357e4273f48c
- 086c073fa31df3cf34971b255843dff6232e8dd7

# OPTIMIZATIONS | VENUS - UNLIST MARKET & BORROW CAP

| ID | Title | Category | Severity | Status |
|---|---|---|---|---|
| CVP-01 | Consider Using Custom Errors | Gas Optimization | Optimization | ● Resolved |

# CVP-01 | CONSIDER USING CUSTOM ERRORS

| Category | Severity | Location | Status |
|---|---|---|---|
| Gas Optimization | ● Optimization | contracts/Comptroller.sol (PR349-Base): 220~230 | ● Resolved |

## Description

From Solidity `v0.8.4` , there are more gas-efficient ways to explain to users why an operation failed than through strings. Using custom errors can significantly reduce the size of the deployed bytecode and reduce the gas cost when calls revert.

## Recommendation

We recommend considering the use of custom errors to reduce gas costs. In addition, throughout the codebase custom errors and string errors are used, can you please clarify the convention being followed for when custom vs. string errors are used.

## Alleviation

`[CertiK, 03/21/2024]` : The client made changes resolving the finding in commit 9fd7543e8dd541f4a29c8cf76ef574ec573a3f7a.

# APPENDIX | VENUS - UNLIST MARKET & BORROW CAP

## Finding Categories

| Categories | Description |
|---|---|
| Gas Optimization | Gas Optimization findings do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction on the total gas cost of a transaction. |
| Coding Style | Coding Style findings may not affect code behavior, but indicate areas where coding practices can be improved to make the code more understandable and maintainable. |
| Language Version | Language Version findings indicate that the code uses certain compiler versions or language features with known security issues. |
| Inconsistency | Inconsistency findings refer to different parts of code that are not consistent or code that does not behave according to its specification. |
| Centralization | Centralization findings detail the design choices of designating privileged roles or other centralized controls over the code. |
| Design Issue | Design Issue findings indicate general issues at the design level beyond program logic that are not covered by other finding categories. |

## 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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