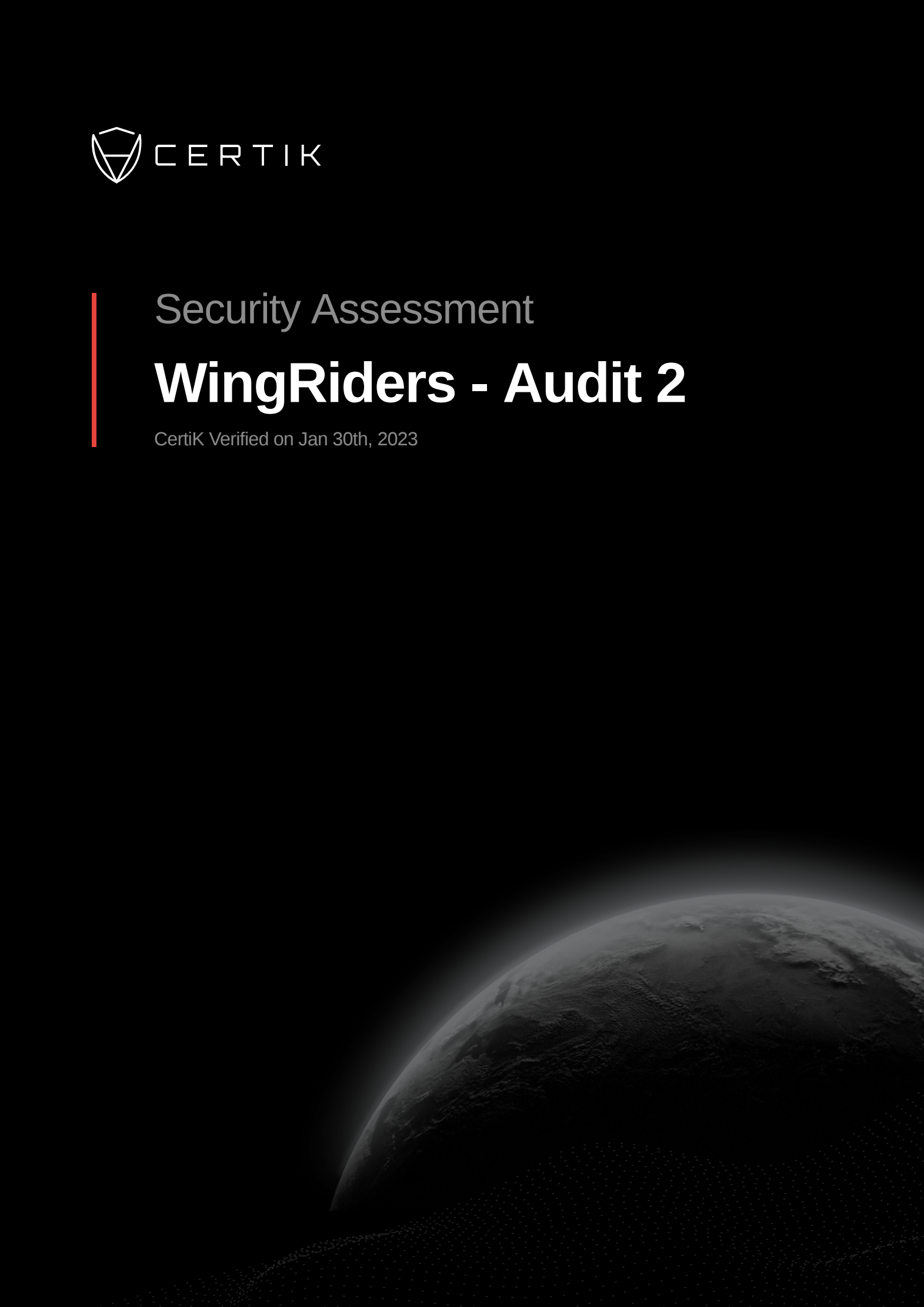
CERTIK

Security Assessment

# WingRiders - Audit 2

CertiK Verified on Jan 30th, 2023

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# WingRiders - Audit 2

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

## Executive Summary

| TYPES | ECOSYSTEM | METHODS |
|---|---|---|
| DeFi | Cardano | Manual Review |

| LANGUAGE | TIMELINE | KEY COMPONENTS |
|---|---|---|
| haskell | Delivered on 01/30/2023 | N/A |

CODEBASE

https://github.com/WingRiders/

...View All

COMMITS

0c5ca5c437d3fb9eff44c12813119c3074417f1b

579aed64ac659b7f43772e1785ab4ea6d619dcaa

...View All

## Vulnerability Summary

| 3 | 3 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|
| Total Findings | Resolved | Mitigated | Partially Resolved | Acknowledged | Declined | Unresolved |

| | | | |
|---|---|---|---|
| 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. |
| 0 | Major | | 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. |
| 0 | Minor | | 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 | WINGRIDERS - AUDIT 2

## Repository

https://github.com/WingRiders/

## Commit

0c5ca5c437d3fb9eff44c12813119c3074417f1b
579aed64ac659b7f43772e1785ab4ea6d619dcaa

# AUDIT SCOPE | WINGRIDERS - AUDIT 2

5 files audited ● 2 files with Resolved findings ● 3 files without findings

| ID | File | SHA256 Checksum |
|---|---|---|
| ● SAM | src/DEX/OnChain/Core/StableswapAMM.hs | 60c149b7f9e0fbfba8cf9b41483d037606792b3d975d23dc5e0c43e039d8e3e2 |
| ● SPC | src/DEX/OnChain/Core/StableswapPool.hs | 4334a163d4bb9abe5323576c3dbf5e51ddd86f1273bb040229f7def81b506a63 |
| ● SPS | src/DEX/OnChain/Core/StableswapPoolState.hs | f14b47d6320bf70e8e9d75643a9fb8785861ce57696aa0d2bb82dd19590a9550 |
| ● SFO | src/DEX/OnChain/StableswapFactory.hs | 424fac158fed4de8b35b0ee40ba4f4c59e57e8d78d6507869f29fd2541e2e1ab |
| ● SPO | src/DEX/OnChain/StableswapPool.hs | 57100366d0ae5f0a6f464f8604f2b3ac6e6251fc82355ad592b064a9eb647106 |

# APPROACH & METHODS | WINGRIDERS - AUDIT 2

This report has been prepared for WingRiders to discover issues and vulnerabilities in the source code of the WingRiders - Audit 2 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.

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 at the informational level only. We recommend addressing these findings to ensure a high level of security standards and industry practices.

# REVIEW NOTES | WINGRIDERS - AUDIT 2

WingRiders is a decentralized exchange (DEX) on the Cardano blockchain, which provides a constant-function automatic market maker. The WingRiders operator creates trading pools containing reserves of two different tokens, and users can either provide liquidity to the pool by depositing tokens into it, or use it to trade one token for another. In order to perform well on the Cardano eUTxO model, WingRiders adopts a batched approach, where orders are submitted via a batching agent who will gather them into batches of multiple orders.

CertiK previously audited the entire WingRiders on-chain contracts (as described in a previous report). At that point it implemented the UniSwap-style constant product equation, i.e. the amount of reserves $x$ and $y$ satisfies $xy = k$ for some $k$. Now it adds support for pools using the StableSwap equation, and in this report we describe our new audit of the added code.

The StableSwap equation is

$$4xy(4A(x+y)+D) = 16ADxy + D^3.$$

Here $A$ is a fixed constant affecting the shape of the curve (in WingRiders $A = 75$) and $D$ is a measure of how much reserves have been deposited in the contract (analogous to $k$ in the constant product formula). This equation is now commonly used by various automatic market makers. Compared to the constant-product formula, it is closer to linear in the region where $x \approx y$. This makes it suitable for pairs of tokens where the price is expected to not fluctuate much, because then it can execute larger trades with small price slips, so it makes more efficient use of the deposited liquidity.

The main operations which we audit are (1) creating new pool, initialized to suitable values. (2) Supplying or withdrawing liquidity from the pool. (3) Executing a trade.

WingRiders is implemented in the Plutus programming language. There are some aspects that depend on the characteristics of Cardano and Plutus:

- Because it is implemented using integer arithmetic rather than real numbers, the equation is not satisfied exactly. Therefore, the contracts check that $D$ satisfies it to the nearest integer, rounded in the right direction (so that the pool does not lose money from rounding).
- For efficiency the general style is to validate rather than compute: the user provides the desired trading amounts, and the contract checks that they will satisfy the equation.
- The trade also incurs a trading fee. Conceptually this is put into a "treasury", to be withdrawn by the pool operator later. However, both reserves and treasury are stored as Plutus values on the same UTxO, so the contract maintains a record in the UTxO datum of how much reserves and treasury it has, and the actual value should be equal to the sum of these.

In the audit, we particularly studied that the mathematical formula was implemented correctly, and also that this business logic was integrated suitably into the existing contract code for executing requests.

# FINDINGS | WINGRIDERS - AUDIT 2

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

This report has been prepared to discover issues and vulnerabilities for WingRiders - Audit 2. Through this audit, we have uncovered 3 issues ranging from different severity levels. Utilizing the techniques of Manual Review to complement rigorous manual code reviews, we discovered the following findings:

| ID | Title | Category | Severity | Status |
|---|---|---|---|---|
| SAM-01 | Use Existing Constant | Magic Numbers | Informational | Resolved |
| SAM-02 | Inconsistent Comments | Inconsistency | Informational | Resolved |
| SPC-01 | Typos | Coding Style | Informational | Resolved |

# SAM-01 | USE EXISTING CONSTANT

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Magic Numbers | Informational | src/DEX/OnChain/Core/StableswapAMM.hs (0c5ca5c437d3fb9eff44c12813119c3074417f1b): 30 | Resolved |

## Description

The literal `10000` is used instead of `swapFeeBasis` defined with the same value in `DEX.OnChain.Common.StableswapProtocolParams`.

## Recommendation

Use the defined value `swapFeeBasis` in `DEX.OnChain.Common.StableswapProtocolParams` instead of the literal `10000`.

## Alleviation

`[CertiK]`: The team heeded the advice and resolved the finding in the commit hash 579aed64ac659b7f43772e1785ab4ea6d619dcaa.

# SAM-02 | INCONSISTENT COMMENTS

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Inconsistency | Informational | src/DEX/OnChain/Core/StableswapAMM.hs (0c5ca5c437d3fb9eff44c12813119c3074417f1b): 34~35 | Resolved |

## Description

In `StableswapAMM.hs` the comment before the function `stableswapProtocolFee` states that the amount of fees for the treasury is 0.01% of the `locked amount` which represents 1/6 of the swap fee, meaning that the amount of fee returned to the pool is 0.05%.
This contradicts the following comments of the function `swapFeeInBasis` from the file `StableswapProtocolParams.hs`:

```
24  --  0.06% is returned in the pool for liquidity providers.
25  --  0.01% goes into the treasury
```

## Recommendation

We recommend correcting the comments.

## Alleviation

`[CertiK]`: The team heeded the advice and resolved the finding in the commit hash 32e100b2cb16b9bdb1af1d3c9785915b5fb281c8.

# SPC-01 | TYPOS

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Coding Style | Informational | src/DEX/OnChain/Core/StableswapPool.hs (0c5ca5c437d3fb9eff44c12813119c3074417f1b): 165, 326 | Resolved |

## Description

The contract contains typos that need to be changed as follows:

```
165        -- The pool and agnet are distinct utxos enforced by the `agentChecked`.
```

should be written:

```
      -- The pool and agent are distinct utxos enforced by the `agentChecked`.
```

```
326  --  This function throws is request is not applied correctly.
```

should be written

```
326  --  This function throws if the request is not applied correctly.
```

## Recommendation

We recommend correcting the typos to improve readability.

## Alleviation

`[CertiK]`: The team heeded the advice and resolved the finding in the commit hash 206fc112dc96efcc1cea7e0213476676a04e31fc.

# APPENDIX | WINGRIDERS - AUDIT 2

## Finding Categories

| Categories | Description |
| --- | --- |
| 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. |
| Inconsistency | Inconsistency findings refer to functions that should seemingly behave similarly yet contain different code, such as a constructor assignment imposing different require statements on the input variables than a setter function. |
| Magic Numbers | Magic Number findings refer to numeric literals that are expressed in the codebase in their raw format and should otherwise be specified as constant contract variables aiding in their legibility and maintainability. |

## 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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