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Bathtub Protocol

Audit

Security Assessment
03. June, 2023

For

BATHTUB PROTOCOL

SolidProof_io

@solidproof_io

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Version	Date	Description
1.0	29. May 2023	• Layout project • Automated- /Manual-Security Testing • Summary
1.1	03. June 2023	• Reaudit

Note - This Audit report includes a security analysis of the **Bathtub Protocol** smart contracts. This analysis did not include functional testing (or unit testing) of the contract's logic.

Network

Arbitrum

Website

http://0xbath.com/

Twitter

https://twitter.com/0xbath

Discord

https://discord.gg/aGRj7auTw6

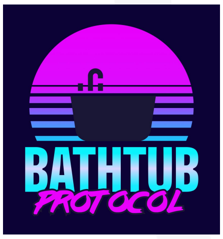
Description

Bathtub is a protocol designed to provide a sustainable growth environment to its users. The protocol achieves this by incorporating a number of features that ensure long-term value creation for its token holders. One of the key features of Bathtub is its use of Arbitrum's bluechip LPs and payment of real yield to it's users.

Project Engagement

During the Date of 25 May 2023, **Bathtub Protocol 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

- https://github.com/bathtub-code/bath-contract
- Commit: d162cbd

v1.1

- https://github.com/bathtub-code/bath-contract
- Commit: 4937b88

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.

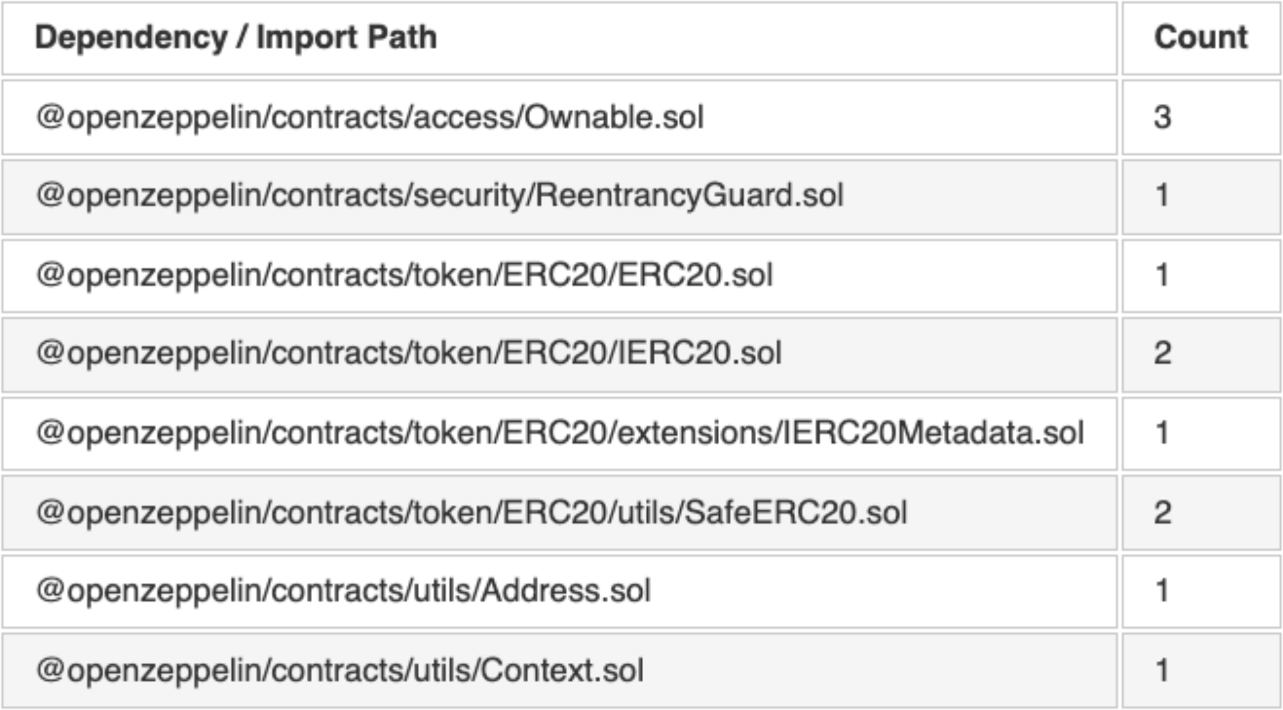
3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarify, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.

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:

v1.0



Dependency / Import Path	Count
@openzeppelin/contracts/access/Ownable.sol	3
@openzeppelin/contracts/security/ReentrancyGuard.sol	1
@openzeppelin/contracts/token/ERC20/ERC20.sol	1
@openzeppelin/contracts/token/ERC20/IERC20.sol	2
@openzeppelin/contracts/token/ERC20/extensions/IERC20Metadata.sol	1
@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol	2
@openzeppelin/contracts/utils/Address.sol	1
@openzeppelin/contracts/utils/Context.sol	1

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.

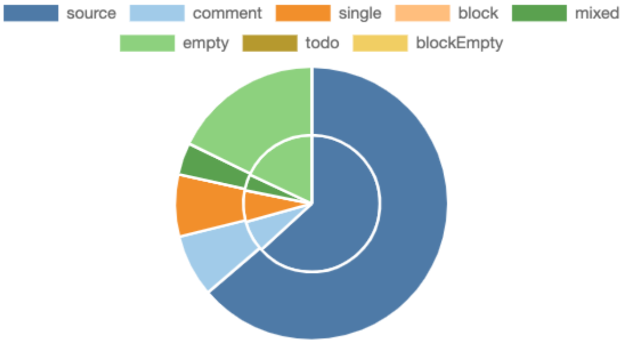
v1.0

File Name	SHA-1 Hash
contracts/BathtubToken.sol	c88fd5f9072ebc6ac98100a26b0e5f171a4575c0
contracts/BathtubFarm.sol	223e8e3ed954458627f01782ef1828bf6258e9f2
contracts/BathtubStaking.sol	1b1938c236799b5c00a7d549c42f895327693b48

Metrics

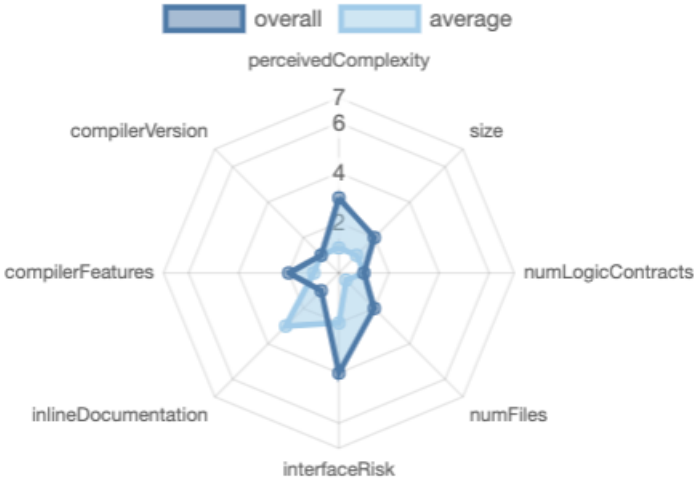
Source Lines

v1.0



Risk Level

v1.0



Capabilities

Components

📝Contracts	📚Libraries	🔍Interfaces	🎨Abstract
3	0	0	0

Exposed Functions

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

🌐Public	💰Payable
32	1

External	Internal	Private	Pure	View
14	44	0	1	7

StateVariables

Total	🌐Public
31	28

Capabilities

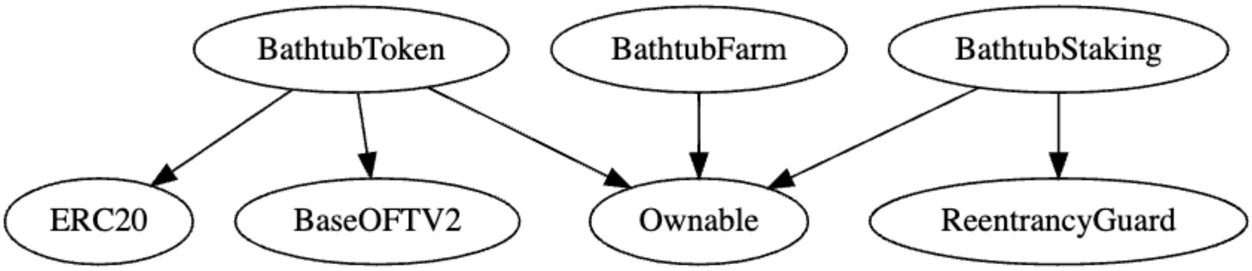
Solidity Versions observed	🧪 Experimental Features	💰 Can Receive Funds	🖥 Uses Assembly	💣 Has Destroyable Contracts
`^0.8.0`		`yes`		

📤 Transfers ETH	⚡ Low-Level Calls	👥 DelegateCall	🧮 Uses Hash Functions	🔖 ECRecover	🌀 New/Create/Create2

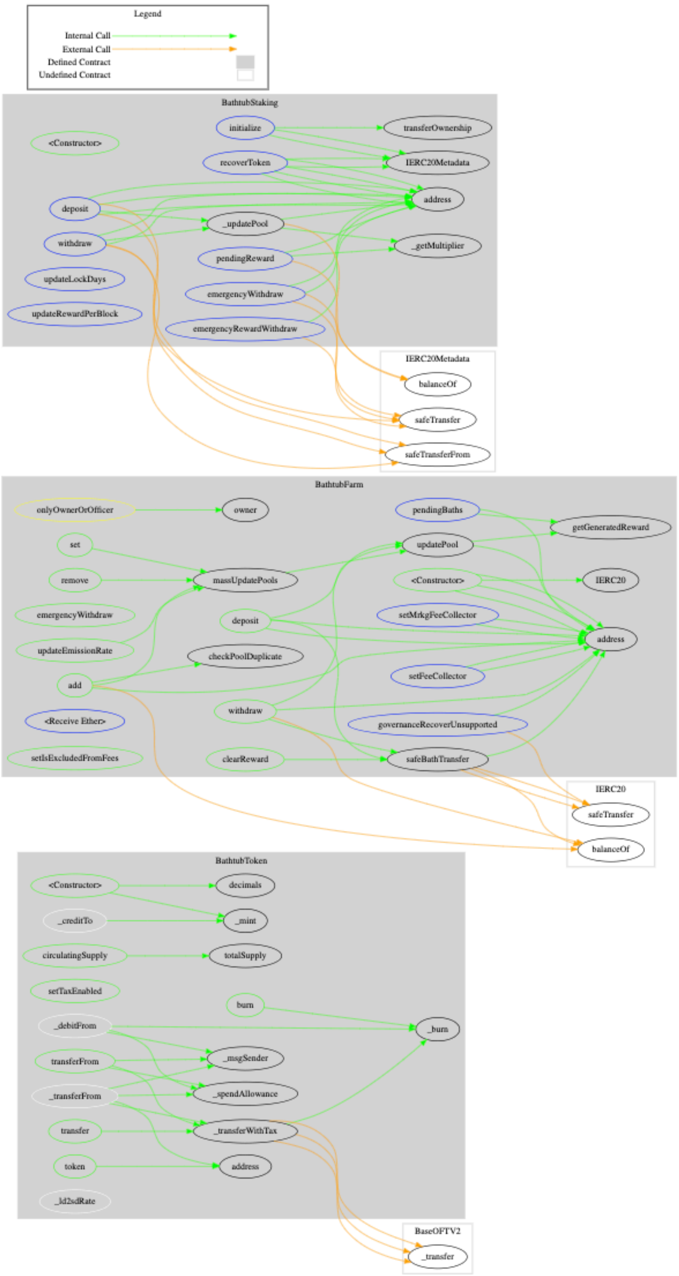
♻️ TryCatch	Σ Unchecked

Inheritance Graph

v1.0



Call Graph
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. Is contract an upgradeable
2. Overall checkup (Smart Contract Security)

Is contract an upgradeable

Name	
Is contract an upgradeable?	No

Overall checkup (Smart Contract Security)

Tested	Verified
✓	✓

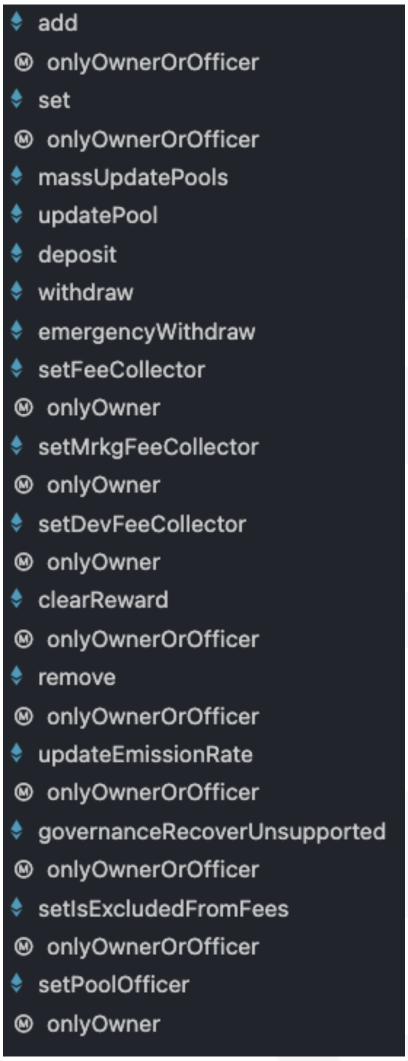
Legend

Attribute	Symbol
Verified / Checked	✓
Partly Verified	🚩
Unverified / Not checked	✗
Not available	–

Modifiers and public functions

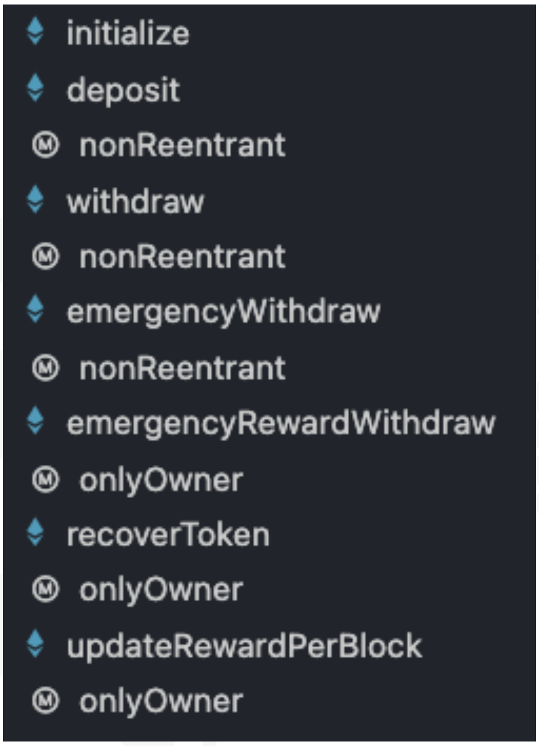
v1.1

BathtubFarm



```
♦ add
Ⓜ onlyOwnerOrOfficer
♦ set
Ⓜ onlyOwnerOrOfficer
♦ massUpdatePools
♦ updatePool
♦ deposit
♦ withdraw
♦ emergencyWithdraw
♦ setFeeCollector
Ⓜ onlyOwner
♦ setMrkgFeeCollector
Ⓜ onlyOwner
♦ setDevFeeCollector
Ⓜ onlyOwner
♦ clearReward
Ⓜ onlyOwnerOrOfficer
♦ remove
Ⓜ onlyOwnerOrOfficer
♦ updateEmissionRate
Ⓜ onlyOwnerOrOfficer
♦ governanceRecoverUnsupported
Ⓜ onlyOwnerOrOfficer
♦ setIsExcludedFromFees
Ⓜ onlyOwnerOrOfficer
♦ setPoolOfficer
Ⓜ onlyOwner
```

BathtubStaking



```
♦ initialize
♦ deposit
Ⓜ nonReentrant
♦ withdraw
Ⓜ nonReentrant
♦ emergencyWithdraw
Ⓜ nonReentrant
♦ emergencyRewardWithdraw
Ⓜ onlyOwner
♦ recoverToken
Ⓜ onlyOwner
♦ updateRewardPerBlock
Ⓜ onlyOwner
```

Ownership/Authority Privileges

❖ *BathtubFarm.sol* -

The owner and the pool officer address have the following privileges

- Add a new pool
- Update a pool with new allocation points, deposit, and withdraw fees that cannot be more than 15%
- Set fee collector address
- Include/Exclude accounts from fees
- Remove a pool at any given time. After that, no rewards or deposits will be given from that pool.
- Withdraw any tokens from the contract balance, including the BATH tokens, but only seven days after a pool ends.

    - Set fee collector addresses.
    - Update the emission rate per second to any arbitrary value.

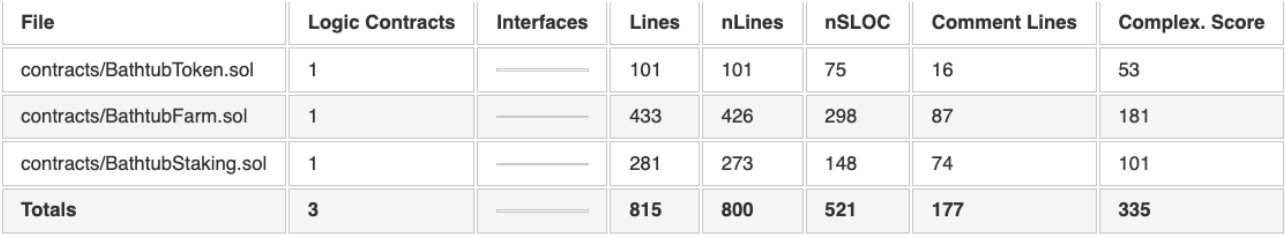
- *BathtubStaking.sol* -
    - The owner can withdraw the contract's reward tokens and any other foreign tokens. Staked token withdrawal is not possible.
    - The owner can update the time lock for the withdrawal at any time and up to any arbitrary value, which is not recommended as this functionality may be used to lock user funds. Beware of this
    - Set Dev fee collector address

- *BathtubToken.sol* -
    - The owner can set the fee address and include/exclude accounts from the fee.

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

Source Units in Scope

v1.0



File	Logic Contracts	Interfaces	Lines	nLines	nSLOC	Comment Lines	Complex. Score
contracts/BathtubToken.sol	1		101	101	75	16	53
contracts/BathtubFarm.sol	1		433	426	298	87	181
contracts/BathtubStaking.sol	1		281	273	148	74	101
Totals	**3**		**815**	**800**	**521**	**177**	**335**

Legend

Attribute	Description
Lines	total lines of the source unit
nLines	normalised lines of the source unit (e.g. normalises functions spanning multiple lines)
nSLOC	normalised 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

Critical issues

No critical issues

High issues

No high issues

Medium issues

Medium Issues Acknowledged

Issue	File	Type	Line	Description	Status
#1	BathtubStaking.sol	Owner can drain rewards	191	The owner can withdraw reward tokens from the contract.	ACK
#2	BathtubStaking.sol	Owner can lock tokens	217	The owner can set the lock days to any arbitrary value and it may lead to the users funds being locked for withdraw	Fixed

Low issues

Issue	File	Type	Line	Description	Status
#1	BathtubFarm.sol	Missing Timelock	326	The withdraw function lacks a timelock and we strongly advise to put a timelock in place for the withdraw, otherwise funds will be available to withdraw right after deposit which increases the risk of bots misusing the contract	Open
#2	All	A floating pragma is set	—	The current pragma Solidity directive is „“^0.8.0” ".	Open
#3	BathtubFarm.sol	Missing Arithmetic events	414	Emit events for critical parameter changes	Open

#4	BathtubFarm.sol	Missing Existence Check	414	We recommend to check whether a Pool ID exist or not and throw an error message before removing a pool	Open

Informational issues

No informational issues

Audit Comments

We recommend you to use the special form of comments (NatSpec Format, Follow link for more information https://docs.soliditylang.org/en/latest/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.

03. June 2023:

- There is still an owner (Owner still has not renounced ownership)
- Unit tests with 95% code coverage were not provided to SolidProof so we cannot ensure complete functional correctness of the code's logic.
- We recommend **Bathtub** team conduct unit and fuzz tests thoroughly to rule out the possibilities of unwanted logical and calculation errors.
- Read the whole report and modifiers section 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	NOT 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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