Smart Contract Security Audit Report

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1 Executive Summary

On 2024.09.18, the SlowMist security team received the Magpie team's security audit application for Penpie Contracts Exploit Fixes, developed the audit plan according to the agreement of both parties and the characteristics of the project, and finally issued the security audit report.

The SlowMist security team adopts the strategy of "white box lead, black, grey box assists" to conduct a complete security test on the project in the way closest to the real attack.

The test method information:

Test method	Description
Black box testing	Conduct security tests from an attacker's perspective externally.
Grey box testing	Conduct security testing on code modules through the scripting tool, observing the internal running status, mining weaknesses.
White box testing	Based on the open source code, non-open source code, to detect whether there are vulnerabilities in programs such as nodes, SDK, etc.

The vulnerability severity level information:

Level	Description
Critical	Critical severity vulnerabilities will have a significant impact on the security of the DeFi project, and it is strongly recommended to fix the critical vulnerabilities.
High	High severity vulnerabilities will affect the normal operation of the DeFi project. It is strongly recommended to fix high-risk vulnerabilities.
Medium	Medium severity vulnerability will affect the operation of the DeFi project. It is recommended to fix medium-risk vulnerabilities.
Low	Low severity vulnerabilities may affect the operation of the DeFi project in certain scenarios. It is suggested that the project team should evaluate and consider whether these vulnerabilities need to be fixed.
Weakness	There are safety risks theoretically, but it is extremely difficult to reproduce in engineering.
Suggestion	There are better practices for coding or architecture.

2 Audit Methodology

The security audit process of SlowMist security team for smart contract includes two steps:

- Smart contract codes are scanned/tested for commonly known and more specific vulnerabilities using automated analysis tools.
- Manual audit of the codes for security issues. The contracts are manually analyzed to look for any potential problems.

Following is the list of commonly known vulnerabilities that was considered during the audit of the smart contract:

Serial Number	Audit Class	Audit Subclass
1	Overflow Audit	-
2	Reentrancy Attack Audit	-
3	Replay Attack Audit	-
4	Flashloan Attack Audit	-
5	Race Conditions Audit	Reordering Attack Audit
6	Permission Vulnerability Audit	Access Control Audit
		Excessive Authority Audit
7	Security Design Audit	External Module Safe Use Audit
		Compiler Version Security Audit
		Hard-coded Address Security Audit
		Fallback Function Safe Use Audit
		Show Coding Security Audit
		Function Return Value Security Audit
		External Call Function Security Audit

Serial Number	Audit Class	Audit Subclass
7	Security Design Audit	Block data Dependence Security Audit
		tx.origin Authentication Security Audit
8	Denial of Service Audit	-
9	Gas Optimization Audit	-
10	Design Logic Audit	-
11	Variable Coverage Vulnerability Audit	-
12	"False Top-up" Vulnerability Audit	-
13	Scoping and Declarations Audit	-
14	Malicious Event Log Audit	-
15	Arithmetic Accuracy Deviation Audit	-
16	Uninitialized Storage Pointer Audit	-

3 Project Overview

3.1 Project Introduction

This is a review of the fix for the Penpie contracts. In this PR, the project team will upgrade the PendleStaking, MasterPenpie, and PendleMarketDepositHelper contracts to remove malicious pools and modify the active status of affected pools. Ultimately, it will allow users to make emergency withdrawals from the affected pools, while unaffected pools will resume normal deposits/withdrawals.

3.2 Vulnerability Information

The following is the status of the vulnerabilities found in this audit:

NO	Title	Category	Level	Status
N1	Code fix situation	Others	Information	Acknowledged

4 Code Overview

4.1 Contracts Description

Audit Version:

https://github.com/magpiexyz/penpie-contracts/pull/181

The main network address of the contract is as follows:

The code was not deployed to the mainnet.

4.2 Vulnerability Summary

[N1] [Information] Code fix situation

Category: Others

Content

In the fix, the project team used OpenZeppelin's ReentrancyGuard library to modify the harvestMarketReward and batchHarvestMarketRewards functions in the PendleStaking contract to address the issue of reentering depositMarket. Additionally, they restricted the registerPool function in the PendleStaking contract to be callable only by the owner role to ensure that newly registered pools are reviewed.

Code location:

contracts/pendle/PendleStakingBaseUpg.sol#L361

```
function registerPool(
    address _market,
    uint256 _allocPoints,
    string memory name,
    string memory symbol
) external onlyOwner {
    if (pools[_market].market != address(0)) {
```

```
            revert PoolOccupied();
        }
        ...
    }
```

contracts/pendle/PendleStakingBaseUpg.sol#L324,L333

```
function harvestMarketReward(
    address _market,
    address _caller,
    uint256 _minEthRecive
) external nonReentrant whenNotPaused _onlyActivePool(_market) {
    address[] memory _markets = new address[](1);
    _markets[0] = _market;
    _harvestBatchMarketRewards(_markets, _caller, _minEthRecive);
}

function batchHarvestMarketRewards(
    address[] calldata _markets,
    uint256 minEthToRecieve
) external nonReentrant whenNotPaused {
    _harvestBatchMarketRewards(_markets, msg.sender, minEthToRecieve);
}
```

In PR181, not only were the aforementioned issues fixed, but efforts were also made to restore the deposit/withdrawal functionality of the protocol. The specific process is as follows:

1.Upgrade PendleStaking, MasterPenpie and PendleMarketDepositHelper contracts and ensure that the contracts are in a suspended state.

2.Use updateAllowedPauser to add allowedPauser for MasterPenpie and PendleStaking.

3.Remove all malicious pools through PendleStaking.batchRemovePools.

3.Mark the affected pools as inactive through PendleStaking.updatePoolHelper.

4.Modify the affected pool's affectedMarketWithdrawRatio through PendleStaking.setAffectedMarketWithdrawRatio to ensure that users withdraw the remaining deposits in proportion.

5.Cancel the suspended state of MasterPenpie and PendleStaking contracts for users to make emergency withdrawals.

It is important to note that the pool removal functionality involved in the above process should be removed after resolving the malicious pool issue to avoid the risk of excessive privileges.

Solution

N/A

Status

Acknowledged

5 Audit Result

Audit Number	Audit Team	Audit Date	Audit Result
0X002409190001	SlowMist Security Team	2024.09.18 - 2024.09.19	Passed

Summary conclusion: The SlowMist security team uses a manual and SlowMist team's analysis tool to audit the project, during the audit work we found 1 infomation. The code was not deployed to the mainnet.

6 Statement

SlowMist issues this report with reference to the facts that have occurred or existed before the issuance of this report, and only assumes corresponding responsibility based on these.

For the facts that occurred or existed after the issuance, SlowMist is not able to judge the security status of this project, and is not responsible for them. The security audit analysis and other contents of this report are based on the documents and materials provided to SlowMist by the information provider till the date of the insurance report (referred to as "provided information"). SlowMist assumes: The information provided is not missing, tampered with, deleted or concealed. If the information provided is missing, tampered with, deleted, concealed, or inconsistent with the actual situation, the SlowMist shall not be liable for any loss or adverse effect resulting therefrom. SlowMist only conducts the agreed security audit on the security situation of the project and issues this report. SlowMist is not responsible for the background and other conditions of the project.

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