Audit of The FaaSPool ValueDeFi Contracts

a report of findings by

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Document Info

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Executive Summary

A Representative Party of the ValueDeFi Finance ("ValueDeFi") engaged The Arcadia Group ("Arcadia"), a software development, research, and security company, to conduct a review of the following FaaSPool smart contracts on the ValueDeFi repo at Commit #f79b7baf41cf2d1347336e067a9d2c1f00718385.

FaaSPool.sol

Arcadia completed the review using various methods primarily consisting of dynamic and static analysis. This process included a line by line analysis of the in-scope contracts, optimization analysis, analysis of key functionalities and limiters, and reference against intended functionality.
Findings

1. Using `uint256/uint` instead of `uint8`

- FAAS-1
- Severity: Medium
- Likelihood: Low
- Impact: Low
- Target: FaaSPool.sol
- Category: Low
- Finding Type: Static
- Lines: 21-24

In the FaaSPool contract, the data structure `UserInfo` takes `uint8` data type for typing pool ID. This would cause overflow, thus reverting rewarding transactions, if there are more than 256 pools in the pool.

```solidity
struct UserInfo {
    uint amount;
    mapping(uint8 => uint) rewardDebt;
    mapping(uint8 => uint) accumulatedEarned; // will accumulate every time user harvest
    mapping(uint8 => uint) lockReward;
    mapping(uint8 => uint) lockRewardReleased;
    uint lastStakeTime;
}
```

Action Recommended: While it seems impractical to have more than 256 pools, the data structure should use `uint256/uint` type for pool identification indexing. Intuitively, the use of `uint8` can save gas cost for contract deployment, but in reality, the use of `uint8` and `uint256/uint` takes up the same memory space in the deployment contract. It is then recommended to change `uint8` to `uint256/uint`.

```solidity
struct UserInfo {
    uint amount;
    mapping(uint => uint) rewardDebt;
    mapping(uint => uint) accumulatedEarned; // will accumulate every time user harvest
    mapping(uint => uint) lockReward;
    mapping(uint => uint) lockRewardReleased;
    uint lastStakeTime;
}
```
Review of the issue: We have reviewed the deployed FaaSPool contract on etherscan, and verified that the issue was resolved by the team.

2. Input parameter value range checking

- FAAS-2
- Severity: Medium
- Impact: Low

Target: FaaSPool.sol
- Category: Informational
- Finding Type: Static
- Lines: 76-95, 97-103

Functions addRewardPool should have value range checking for input parameters _rewardPerBlock and _lockRewardPercent. Even though rewardPerBlock can be adjusted per pool via function updateRewardPool, having value range checking in the function is still recommended in order to avoid an unexpectedly high inflation. Furthermore, _lockRewardPercent should at least be less than 100. Any manual input mistake that puts that value for this parameter above 100 would lead to incorrect functioning of the contract.

A similar issue is found in function updateRewardPool, which updates the _rewardPerBlock and _endRewardBlock.

- _endRewardBlock in function updateRewardPool should be checked for its value range greater than the current block number. Any mistake that puts _endRewardBlock greater than block number will cease the rewarding in the updated pool.

```solidity
function addRewardPool(IERC20 _rewardToken, uint256 _startBlock, uint256 _endRewardBlock, uint256 _rewardPerBlock,
    uint256 _lockRewardPercent, uint256 _startVestingBlock, uint256 _endVestingBlock) public
\nonlyController {
    require(_startVestingBlock <= _endVestingBlock, "sVB>eVB");
    _startBlock = (block.number > _startBlock) ? block.number : _startBlock;
    require(_startBlock < _endRewardBlock, "sB>eB");
    updateReward();
    rewardPoolInfo.push(RewardPoolInfo({
        rewardToken : _rewardToken,
        lastRewardBlock : _startBlock,
        endRewardBlock : _endRewardBlock,
        rewardPerBlock : _rewardPerBlock,
        accRewardPerShare : 0,
        lockRewardPercent : _lockRewardPercent,
        startVestingBlock : _startVestingBlock,
        endVestingBlock : _endVestingBlock,
        numOfVestingBlocks: _endVestingBlock - _startVestingBlock,
        totalPaidRewards: 0,
    }));
```
Action Recommended: Add value range checking for the input parameters in the two functions `addRewardPool` and `updateRewardPool`.

Review at commit #454f7ffe97da1d9285f1ee8958819e3561846b40: The issue was fixed by the team.

3. Gas cost in function `updateRewardPool`

- FAAS-3
- Severity: Low
- Likelihood: Low
- Impact: Low
- Target: FaaSPool.sol
- Category: Informational
- Finding Type: Static
- Lines 97-103

In the function, `updateRewardPool`, the function will revert if the block number (at transaction time) is greater than the pool reward end block. If so, the transaction still costs gas for executing function `updateReward` even though any state update in the function `updateReward` will be reverted as the whole transaction will be reverted.

In order to minimize gas cost in this case scenario, the statement `require(block.number <= rewardPool.endRewardBlock, "late");` should be called before the function `updateReward` gets executed.
Action Recommended: Rearrange the function to put the `require` statement before the `updateRewardPool` function call.

```solidity
function updateRewardPool(uint8 _pid, uint256 _endRewardBlock, uint256 _rewardPerBlock) public onlyController {
    RewardPoolInfo storage rewardPool = rewardPoolInfo[_pid];
    require(block.number <= rewardPool.endRewardBlock, "late");
    require(_endRewardBlock > block.number, "reward ceasing");
    rewardPool.endRewardBlock = _endRewardBlock;
    rewardPool.rewardPerBlock = _rewardPerBlock;
}
```

Review at commit #454f7fe97da1d9285f1ee8958819e3561846b40: The issue was fixed by the team.

4. Function pendingReward does not take into account locked rewards

- FAAS-4
- Severity: low
- Likelihood: Low
- Impact: Low

- Target: FaaSPool.sol
- Category: Low
- Finding Type: Dynamic
- Lines: 105-118

In the FaaSPool contract, function pendingReward currently does not take into account user locked rewards. In practice, a user would like to check the total rewards that the user will receive when the user calls that function.

```solidity
function pendingReward(uint8 _pid, address _account) public override view returns (uint _pending) {
    UserInfo storage user = userInfo[_account];
    RewardPoolInfo storage rewardPool = rewardPoolInfo[_pid];
    uint _accRewardPerShare = rewardPool.accRewardPerShare;
    uint lpSupply = balanceOf(address(this));
    uint _endRewardBlockApplicable = block.number > rewardPool.endRewardBlock ?
        rewardPool.endRewardBlock : block.number;
    if (_endRewardBlockApplicable > rewardPool.lastRewardBlock && lpSupply != 0) {
        uint _numBlocks = _endRewardBlockApplicable.sub(rewardPool.lastRewardBlock);
```
Action Recommended: The function should return pending reward and locked rewards.

Review at commit #454f7ffe97da1d9285f1ee8958819e3561846b40: As discussed with the team, this is intended as there is a separate function for reading locked rewards.

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