CALL TO ORDER
PLEDGE OF ALLEGIANCE
ROLL CALL

ANNOUNCEMENTS
1.) We would appreciate it if you would turn your cell phones off during this meeting.
2.) A sign-in sheet is located by the door, if you have not already done so, please sign in before you leave.

CONFLICTS OF INTEREST

UNSCHEDULED PUBLIC COMMENTS – COMMENTS ARE LIMITED TO 3 MINUTES
(This time is reserved for members of the public to make a presentation to the Board on items or issues that are not scheduled on the agenda. The Board will not discuss/debate these items, nor will the Board make any decisions on items presented during this time, rather, the Board will refer the items to staff for follow up.)

SCHEDULED PRESENTATIONS/DELEGATIONS – NONE.

APPROVAL OF MINUTES:
* 1.) January 28, 2019 (Page E1)

FINANCE REPORTS
* 1.) Accounts Payable- January 2019 (Page E3)
* 2.) Town of Grand Lake Revenue & Expenditures Summary- December 31, 2018 (Page E12)
* 3.) Financial Information Email- Town Treasurer Ackerman (Page E15)

OLD BUSINESS- NONE.

NEW BUSINESS-
*1.) Sam Mamet Retirement Gift (Page E16)
*2.) Consideration to Appoint New Trustee to Fill the Board of Trustees Vacancy (Page E17)
*3.) Consideration to Appoint Trustees to Open Committee Vacancies (Page E23)
*4.) Consideration to approve Ordinance XX-2019, an ordinance amending Chapter 12, Article 6 [Land Subdivision] and repealing Chapter 12, Article 9, Section 8 [Redevelopment Procedure] of the Town of Grand Lake Municipal Code, to establish regulation for Lot Consolidations and Lot Line Adjustments. (Page E24)
*5.) QUASI-JUDICIAL (PUBLIC HEARING) Continuation of public hearing on the request for Planned Development (PD) Amendment for the Grand Lake Lodge Planned Development located on property at 15500 US Hwy 34, Town of Grand Lake, CO. (Page E31)

LOCAL LIQUOR LICENSING AUTHORITY- QUASI-JUDICIAL- NONE.

EXECUTIVE SESSION: To discuss the purchase, acquisition, lease, transfer, or sale of real, personal, or other property interest under C.R.S. Section 24-6-402(4)(a), specifically, the Middle Park Medical Lease Agreement.

NEW BUSINESS: Consideration to approve the Lease Agreement between the Town of Grand Lake, a Colorado statutory municipality, and Kremmling Memorial Hospital District, a quasi-municipal corporation and Colorado Special District, doing business as Middle Park Health. (Page E284)

MAYOR'S REPORT AND COMMENT

ADJOURNMENT
RECORD OF PROCEEDINGS

REGULAR MEETING
TOWN OF GRAND LAKE BOARD OF TRUSTEES
MONDAY, JANUARY 28, 2019 5:00 P.M.

CALL TO ORDER:
The regular meeting of the Board of Trustees was called to order by Trustee Southway at 5:02 p.m. at the Town Hall, 1026 Park Avenue.

PLEDGE OF ALLEGIANCE:
Trustee Southway led everyone in reciting the Pledge of Allegiance.

ROLL CALL PRESENT:
Trustees Bruton, Southway, Rourke and Price; Town Clerk Carrell, Town Code Administrator ORourke, and Town Planner Shull.

ABSENT:
Trustee Rourke made a motion to excuse Mayor Peterson and Mayor Pro-Tem Kudron from tonight’s meeting. Trustee Price seconded the motion. Town Clerk Carrell completed a roll call vote:

<table>
<thead>
<tr>
<th>Trustee</th>
<th>Vote</th>
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<tbody>
<tr>
<td>Trustee Bruton</td>
<td>Aye</td>
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<tr>
<td>Trustee Price</td>
<td>Aye</td>
</tr>
<tr>
<td>Trustee Rourke</td>
<td>Aye</td>
</tr>
<tr>
<td>Trustee Southway</td>
<td>Aye</td>
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ANNOUNCEMENTS:
Trustee Southway announced that it would be appreciated if cell phones were turned off during the meeting.

Trustee Southway announced that a sign-in sheet is located by the door and to please sign in before leaving.

"Under the Big Top", a Creative Workshop Festival to be held Friday, February 8th. For event information please visit: gced.events.idloom.com/underthebigtop

CONFLICTS OF INTEREST:
Trustee Southway stated that if there are any Trustees wishing to announce a conflict of interest with any items on this evening’s agenda, they should do so at this time.

No conflicts of interest.

TRUSTEE GENERATED TOPICS
Trustee Southway discussed planning/construction items that come in front of the Trustees without going in front of the Planning Commission.

Trustee Southway also expressed interest to have the Board discuss setting a level/percentage they are comfortable with in regards to line item expenses (including streetscape) that go over the approved budget and who should be informing the Board.

Trustee Bruton inquired about the status of town employee raises and bonuses not being completed, he feels this is important that it is should be addressed as soon as possible.

UNSCHEDULED PUBLIC COMMENTS:
Trustee Southway announced that this time is reserved for members of the public to make a presentation to the Board on items or issues that are not scheduled on the agenda. The Board will not discuss/debate these items, nor will the Board make any decisions on items presented during this time, rather, the Board will refer the items to staff for follow up. He then asked if there were any unscheduled public comments and noted that comments are limited to 3 minutes.

NONE.

SCHEDULED PRESENTATION/DELEGATIONS: NONE.

APPROVAL OF JAN. 14, 2019 MINUTES:
Trustee Bruton made a motion to approve the January 14, 2019 minutes. Trustee Rourke seconded the motion. Town Clerk Carrell completed a roll call vote:

01/28/2019 Town of Grand Lake – Board of Trustees
RECORD OF PROCEEDINGS

APPROVAL OF ACCOUNTS PAYABLE:

Trustee Price made a motion to approve the unaudited financial reports. Trustee Bruton seconded the motion. Town Clerk Carrell completed a roll call vote:

- Trustee Rourke: Aye
- Trustee Southway: Aye
- Trustee Bruton: Aye
- Trustee Price: Aye

OLD BUSINESS:

NONE.

NEW BUSINESS

1.) Special Event Permit Application- Grand Lake Concert, Donna

Presented by Town Code Administrator ORourke.

Donna Ready was in attendance and gave a short presentation of the setup for the July 5th concert to the Board.

Trustee Rourke made a motion to approve the Special Event Permit Application for the Grand Lake Concert with the stipulations that Staff and Donna Ready will go over all incidentals to complete this event. Trustee Price seconded the motion. Town Clerk Carrell completed a roll call vote:

- Trustee Bruton: Aye
- Trustee Southway: Aye
- Trustee Price: Aye
- Trustee Rourke: Aye

2.) Consideration to appoint NWCCOG Representatives

Presented by Town Clerk Carrell on behalf of Town Manager White.

Town Clerk Carrell recommended to the Board that they push this off until the next meeting on February 11, 2019 to allow the new Trustee filling the vacancy an opportunity to be involved.

All Trustees decided to move this item to the next meeting.

LIQUOR LICENSING AUTHORITY: NONE.

MAYOR’S REPORT AND COMMENT:

Trustee Southway thanked everyone for attending tonight’s meeting.

ADJOURNMENT:

At 6:00 p.m. Trustee Rourke made a motion to adjourn, seconded by Trustee Bruton; Town Clerk Carrell completed a roll call vote:

- Trustee Price: Aye
- Trustee Southway: Aye
- Trustee Bruton: Aye
- Trustee Rourke: Aye

__________________________
CINDY SOUTHWAY,
TRUSTEE

__________________________
ALAYNA CARRELL,
TOWN CLERK

01/28/2019 Town of Grand Lake – Board of Trustees
ATTACHMENT A

ACCOUNTS PAYABLE - ALREADY PAID

ALREADY PAID

CREDIT UNION OF COLORADO  DUE 2/15/19 - CREDIT CARD PAYMENT  $1,636.47

TOTAL ALREADY PAID  $1,636.47

PAYROLL ALREADY PAID

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**TOTAL Gross Salaries** | $51,098.40 | $17,614.06 | $1,050.52 | **$69,762.98**

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**Total Payroll Taxes/Benefits**  **$50,319.24**
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TOWN OF GRAND LAKE COMBINED ACCOUNTS PAYABLE AND ACCOUNTS PAYABLE - ALREADY PAID (ATTACHMENT A): JANUARY 2019

MAYOR: ____________________________________________

JAMES C PETERSON, MAYOR

ATTEST: ____________________________________________

ALAYNA CARRELL, TOWN CLERK
### Total General Fund Add'l Expenditures (Not in Budget)

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### Net Revenue

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### 2017-2018 Budget Summary

- **Total Revenue Over Expenditures**: $9,000,000
- **Net Revenue**: $9,000,000

**Change from 2017**

- **% Change**: 10.0%

**2017 YTD**

- **Board Packet 2017 YTD**: $9,000,000
- **2018 Budget**: $9,000,000
- **Period Actual YTD**: $9,000,000
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**November Year to Date**

**Net Income from Rental Licenses**

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<tr>
<th>Year</th>
<th>Difference</th>
<th>22,745%</th>
<th>955%</th>
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<td>2017</td>
<td>$22,745</td>
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<tr>
<td>2018</td>
<td>$31,600</td>
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**Sales Tax Income**

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**Year to Date Net Revenue Over Expenditures ($1.826 million)**

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**Cash & Investment Balances**

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<th>22,745%</th>
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**Board Packet Page**

Town of Grind Lake - December 2018 Financial Information
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<table>
<thead>
<tr>
<th>Year to Date Net Revenue Over Expenditures (2018 Budgeted amount = $12.2 million)</th>
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<th>Cash &amp; Investment Balances</th>
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<td>1,003,966</td>
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Town of Grand Lake - December 2018 Financial Information
Hi Cindy,

I had been working on the revenue changes the Board requested, but then W-2s and the first payroll of the year happened so I apologize for not getting the information out before now.

The General Fund is looking at a $12,901 decrease in revenues with the currently adopted 2019 fee and deposit schedule and subtraction of the anticipated funds for requiring nightly rental property owners to also purchase a business license. The increase in the Nightly Rental license fee had been removed from the budget prior to adoption. The currently adopted budget for the general fund is spending $423,125 from reserves, with the revenue decrease there would instead be a $436,026 decrease in reserves. A supplemental budget is only required if the Board wants to expend unanticipated revenues, however, the Board may adopt a supplemental budget if it decides to budget for less expenditures.

The Marina Fund expenditures were $64,193 more than was originally reflected increasing the $148,100 being spent from reserves to $212,293.

The deposits and reimbursements from all land use applications are recorded in account number 10-341-300 Zoning and Subdivision Review. Nate keeps account of all fees expended and reimbursed for each developer/project and bills them accordingly. I have copied him on this email and he can provide this information to you for the Grand Lake Lodge project.

As always, please let me know if you need anything further.

Erin Ackerman, Treasurer

Town of Grand Lake
1026 Park Avenue
PO Box 99
Grand Lake, CO 80447-0099
(970) 627-3435 p
(970) 627-9290 f
From: Margaret Bowes <mbowes@coskitowns.com>
Date: February 1, 2019 at 1:53:55 PM EST
To: Margaret Bowes <mbowes@coskitowns.com>
Subject: Sam Mamet Retirement Gift

Hello All,

I'm following up on the below email regarding a retirement gift for Sam Mamet, Colorado Municipal League. If each Colorado CAST jurisdiction can contribute $100, we should be able to purchase both an Epic and Ikon Pass for Sam for next season.

Please let me know ASAP if your town will contribute $100 and CAST will send you an invoice. We will present the gift to Sam (along with the various golf and other passes that folks have already contributed) at the March 7 Denver meeting.

Best,

Margaret Bowes, Executive Director
Colorado Association of Ski Towns
PO Box 3823
Dillon CO 80435
970-389-4347
mbowes@coskitowns.com
www.coskitowns.com

From: Margaret Bowes [mailto:mbowes@coskitowns.com]
Sent: Tuesday, December 18, 2018 11:56 AM
To: Margaret Bowes
Subject: Sam Mamet Retirement

Hello CAST Members,

As you Colorado municipal folks know, Sam Mamet is retiring from the Colorado Municipal League (CML) after 40 years! When the previous director, Ken Bueche retired, many local governments throughout the state, including many of our CAST members, sent him off with loads of golf passes and lift tickets. We are hoping to do the same for Sam to recognize the absolutely outstanding service he has provided to Colorado municipalities.

Sam retires in March. He loves to ski, and rumor has it that he plays golf ... somewhat. So we are endeavoring to scrounge up some lift tickets (this season will work, but next season would be preferable if possible) and golf passes.

Anything CAST members can contribute is appreciated. Please send the items to me by March 1 at the address below. We will arrange for a formal presentation to Sam on behalf of CAST.

Best,

Margaret Bowes, Executive Director
Colorado Association of Ski Towns
February 11, 2019

To: Mayor Peterson & Grand Lake Board of Trustees  
From: Alayna Carrell, Town Clerk

RE: Consideration to Appoint New Trustee to Fill the Board of Trustees Vacancy

Good evening,

On December 11, 2018 Trustee Tom Goodfellow submitted his resignation effective immediately. I have received two letters of interest from citizens meeting the qualifications for appointment that were received within the timeline. Tom Weydert and Kirsten Heckendorf are both over the age of 18 and have lived within the town limits for a minimum of twelve months.

The Board should consider the interested applicants to fill the vacancy. Additionally, per State Statute, all elected and appointed officials shall take an oath administered by the Municipal Judge, Town Clerk, or other person who is designated by the governing body or who is authorized by law to administer oaths, to support the Constitution of the United States and the State Constitution.

Suggested Motion:
I move to appoint___________ to serve on the Board of Trustees as Trustee filling the vacancy with a term expiration of April 2020. I further move to designate Mayor Peterson to administer the Oath of Office to the appointed Trustee.

Thank you.
CHAPTER 2: ADMINISTRATION
ARTICLE 3: BOARD OF TRUSTEES

2-3-1 Corporate Authority
The corporate authority of the Town is vested in a Board of Trustees, consisting of one Mayor and six Trustees. (C.R.S. 31-4-301(1), 1973)

2-3-2 Authority in General
The Board of Trustees shall constitute the legislative body of the Town, and shall have power and authority, except as otherwise provided by statute, to exercise all power conferred upon or possessed by the Town, and shall have the power and authority to adopt such Ordinances and Resolutions as it shall deem proper in the exercise of its powers.

2-3-3 Appointment of Officers

(A) The Board of Trustees shall appoint a Recorder, who shall be designated as the Town Clerk, a Town Treasurer, a Town Attorney, a Town Marshall, who shall be designated as the Chief of Police, and a Municipal Judge. (C.R.S. 31-4-304, 1973)(C.R.S. 31-4-306, 1973) (C.R.S. 13-10-105, 1973)

(B) The Board of Trustees may appoint other officers as it may deem necessary for good government of the Town, and prescribe their duties, fix their compensation and require an oath of affirmation. (C.R.S. 31-4-304, 1973)

(C) All appointments of officers shall be by Ballot and concurrence of a majority of the members elected to the Board is required. The names of those who voted, and the vote of each candidate received upon the vote resulting in an appointment shall be recorded. (C.R.S. 31-16-108, 1973)

(D) All appointed officers shall be appointed by the Board of Trustees at the first regular meeting after each regular election, and shall hold their respective offices for a term of two (2) years, or until their respective successors are appointed and qualified.

2-3-4 Filling Vacancies in Appointive Offices
The Board of Trustees shall have power, by appointment, to fill all vacancies in any appointive office, and the person so appointed shall hold office until after the next regular election and until his successor is appointed and qualified. (C.R.S. 31-4-303, 1973)

2-3-5 Filling Vacancies in Elective Offices
The Board of Trustees shall have power, by appointment, to fill all vacancies in the Board or in any other elected office, and the person so appointed shall hold office until the next regular election and until his successor is elected and qualified. If the term of the person creating the vacancy was to extend beyond the next regular election, the person elected to fill the vacancy shall be elected for the unexpired term. Where a vacancy or vacancies exist in the office of trustee and a successor or successors to be elected at the next election to fill the unexpired term or terms, the three candidates for trustee receiving the highest
number of votes shall be elected to four-year terms and the candidate or candidates receiving the next highest number of votes, in descending order, shall be elected to fill the unexpired term or terms. (C.R.S. 31-4-301(5), 1973, 1979 Supp.)

2-3-6 Removal of Officers
By the vote of four (4) Trustees, the Mayor, the Clerk, the Treasurer, the Marshall, any member of the Board, or any other officer of the Town may be removed from office. No such removal shall be made without a charge in writing and an opportunity of Hearing being given unless the Officer against whom the charge is made has moved out of the limits of the Town. When any Officer ceases to reside within the limits of the Town, he may be removed from office pursuant to (C.R.S. 31-4-307, 1973, As Amended). A municipal Judge may be removed during his term of office only for cause, as set forth in (C.R.S. 13-10-105(2), 1973),(C.R.S. 31-4-307, 1973, As Amended)

2-3-7 Combined Offices
The Board of Trustees may appoint one person to hold more than one office, where such offices are compatible. The Board of Trustees may appoint one person to hold the office of Town Clerk and Town Treasurer.

2-3-8 Intergovernmental Contracts and Agreements
The Board of Trustees shall have authority, on behalf of the Town, to enter into contractual arrangements with one or more other governmental bodies for the performance of any governmental service, activity or undertaking which could be performed by each of the governmental bodies, in accordance with the requirements of State Law. (C.R.S. 29-1-203, 1973)

2-3-9 Committees
Any question pending before the Board of Trustees may be referred to a standing committee, or to a special committee, for its consideration and report. Standing committees shall be appointed at a regular meeting by the Mayor.
Good morning
I would like to be considered for appointment of the current vacancy on the Board of Trustees.

Thank you
Tom Weydert
Hi Alayna,

Please consider this to be my letter of interest for the open board seat scheduled for vote on February 11, 2019.

I am a resident of Grand Lake, over the age of 18, and a registered voter in Grand County.

Please let me know if you need anything else from me to complete an application.

Thank you for your consideration.

Kirsten Heckendorf
846 Lake Avenue
303-378-7507
OATH OF OFFICE

STATE OF COLORADO  )
COUNTY OF GRAND    )ss.
TOWN OF GRAND LAKE )

I, ____________, do solemnly swear or affirm that I will support the Constitution of the United States of America, the Constitution of the State of Colorado, and the Ordinances of the Town of Grand Lake, Colorado; that I will bear true faith and allegiance to the same; that I take this obligation freely and without any mental reservations or purpose of evasion; and that I will well and faithfully perform the duties of the office of Trustee for the Town of Grand Lake, Colorado.

(Name)

Subscribed and sworn or affirmed to before me this 11th day of February, 2019.

Jim Peterson, Mayor
Authorized Official Administering Oath
TOWN OF GRAND LAKE, COLORADO
February 11, 2019

To: Mayor Peterson & Grand Lake Board of Trustees
From: Alayna Carrell, Town Clerk

RE: Consideration to Appoint Trustees to Open Committee Vacancies

Good evening,

The following Trustees are currently sitting on the committees listed below. Please appoint a Trustee to fill any vacancies.

Grand Lake Chamber of Commerce
- Vacancy
- Trustee Southway

Northwest Colorado Council of Governments
- Vacancy
- Jim White, alternate

Grand County Water Network
- Vacancy

Financial Trustee
- Vacancy
- Trustee Southway

CML Planning Committee
- Trustee Bruton

Thank you.

Suggested Motions:
*I move to appoint Trustee _____ to the Grand Lake Chamber of Commerce.

*I move to appoint Trustee _____ to be a representative for Northwest Colorado Council of Governments.

*I move to appoint Trustee _____ to be a representative for Grand County Water Network.

*I move to appoint Trustee _____ as a new Financial Trustee.

P.O. BOX 99, GRAND LAKE, COLORADO 80447-0099
PH. 970/627-3435
FAX 970/627-9290
E-MAIL: town@townofgrandlake.com
DATE: 02/01/2019

TO: Mayor Peterson and Board Trustees

FROM: Nate Shull, Town Planner

RE: Consideration to approve Ordinance XX - 2019, an ordinance amending Chapter 12, Article 6 [Land Subdivision] and repealing Chapter 12, Article 9, Section 8 [Redevelopment Procedure] of the Town of Grand Lake Municipal Code, to establish regulation for Lot Consolidations and Lot Line Adjustments

Attachments:
Ordinance XX - 2019 – Amending and Repealing Code: Resubdivision

Purpose
By Resolution 01- 2019, the Planning Commission recommended amending and repealing sections of the Grand Lake Municipal Code for the inclusion of regulation on resubdivisions categorized as Lot Consolidation and Lot Line Adjustments. An ordinance to adopt such regulation is being presented for Board approval.

Staff Recommendation
Staff recommends the Board approve Ordinance XX – 2019, as written.

Board Discussion
The Board should discuss the above information and provide comments/feedback

Board Action
The Board has the following options:
➢ Approve Ordinance XX – 2019 as written
➢ Approve Ordinance XX – 2019 with conditions
➢ Deny Ordinance XX – 2019
TOWN OF GRAND LAKE
BOARD OF TRUSTEES
ORDINANCE NO. XX - 2019

AN ORDINANCE AMENDING CHAPTER 12, ARTICLE 6 [LAND SUBDIVISION] AND REPEALING CHAPTER 12, ARTICLE 9, SECTION 8 [REDEVELOPMENT PROCEDURE] OF THE TOWN OF GRAND LAKE MUNICIPAL CODE TO ESTABLISH REGULATIONS FOR LOT CONSOLIDATIONS AND LOT LINE ADJUSTMENTS

WHEREAS, the Board of Trustees of the Town of Grand Lake (the “Board”), pursuant to Colorado Revised Statutes and the Town of Grand Lake Municipal Code (“The Code”), is vested with the authority to perform such duties as are conferred upon them; and,

WHEREAS, the authority of the Board includes, but is not limited to, adopting ordinances which amend, repeal, or change Code related to land use matters, and;

WHEREAS, the Town of Grand Lake had previously adopted subdivision and land development regulations under Chapter 12, Article 6 and Chapter 12, Article 9 of the Code, respectively, pursuant to Sections 31-23-214, et seq., Colorado Revised Statutes, including regulations specifying procedures for preliminary and final plats, major and minor land developments, amendments to land use developments, and redevelopments; and,

WHEREAS, Town Staff has recommended a simplified regulatory procedure for consolidating lots or for adjusting lot lines; and,

WHEREAS, Town staff has concluded that if the new process for consolidating lots and adjusting lot lines is adopted Code section 12-9-8 [redevelopment procedures] will no longer be necessary or beneficial; and,

WHEREAS, the Board has determined that it is in the interest of the Town to establish regulations lot consolidations and lot line adjustments to clarify and simplify the procedures that apply to these types of subdivisions.

NOW THEREFORE THE BOARD OF TRUSTEES OF THE TOWN OF GRAND LAKE, COLORADO ADOPTS THE FOLLOWING:

THAT, Chapter 12, Article 6 of the Town of Grand Lake Municipal Code is hereby amended, and Chapter 12, Article 9, Section 8 is hereby repealed and replaced, to read as follows:

12-6-5 Definitions
Lot Line Adjustment – The relocation of boundary lines between contiguous legal lots under the same or separate ownership that does not result in any additional lots

Lot Consolidation – The combination of two (2) or more contiguous legal lots under the same ownership into fewer lots

12-6-8 Resubdivision Regulations

(A) Lot Line Adjustments

Any property owner requesting to relocate boundary lines between contiguous legal lots must apply for a Lot Line Adjustment to be submitted for review by the Planning Commission and approval by the Board of Trustees.

1. Lot Line Adjustments are defined as meeting all of the following criteria:
   a. Affecting property that was previously subdivided into legally recognized lots or parcels
   b. Not creating additional lots as a result
   c. Not creating or resulting in the creation of a lot or parcel of land that would violate or fail to conform to any applicable zoning or other standard or regulation including, but not limited to, lot area, minimum frontage, building height, setbacks, density, public or private road or private drive standards, parking, or access.
   d. Not altering public right-of-way or easements reserved for drainage or utilities of any kind located on the subject lots

2. Submittal Requirements

   a. The applicant shall provide the following submission materials:
      1. Application Form
      2. Application fee or deposit
      3. Proof of ownership in the form of a deed of title
         a. If there is more than one owner, a deed transferring ownership of the parcel(s) with the legal description of the resultant parcel(s) is required
         b. If there is only one owner, a legal description of the resultant parcel(s) is required on the plat or deed
      4. Project description (narrative) including the following:
         a. Detailed description of lot and block numbers, new location of adjusted lot line with project coordinates, and resulting lot acreages
         b. Detailed description of type, size, and location of existing structures on all lots.
      5. A list of and addresses for all owners of adjacent property and all owners of easements over, through, or across the property.
6. Lot Line Adjustment Plat (24" x 34") prepared by a registered land surveyor and drawn to a scale of no less than 1" = 50’ (see 12-9-2 (E) and 12-9-11 (K) for specific items)

3. Review Procedures
   a. The Town Planner will have fourteen (14) days from date of submission to determine completeness. Upon acceptance by the Town Planner for submission completeness, the Lot Line Adjustment request shall be reviewed by Town Planning Commission at the next regularly scheduled public meeting. After receipt of recommendation by the Planning Commission, the Board shall review the Lot Line Adjustment request at their next regularly scheduled public meeting.

4. Review Criteria
   a. The Planning Commission and Board of Trustees shall apply the following review criteria in considering an application. No application shall be approved unless the Board of Trustees determines that all criteria have been met:
      1. The resultant lots are legal lots as defined in section 12-6-8 (A) 1
      2. The resultant lots are not in a recorded subdivision
      3. The lot line adjustment would not adversely affect existing access, drainage, utility easements, or rights-of-way
      4. The lot line adjustment would not adversely affect adjacent properties and the property owners’ enjoyment of their property
         The lot line adjustment would not create a nonconforming setback

5. Procedure Following Approval
   a. Where the Board of Trustees has determined that a proposed Lot Line Adjustment complies with the requirements of these regulations, the Final Lot Consolidation Plat shall be endorsed by the Chair of the Planning Commission and the Mayor of the Town and thereafter the Town Clerk shall file the approved Plat with the Town and record it with the Grand County Clerk and Recorder.
      1. for any existing building [NS: I am not sure what this item 1. Is referring to??]

(B) Lot Consolidations
   Any property owner requesting to combine two or more contiguous legal lots in a previously recorded subdivision, planned development, or traditional residential development, which are owned by the same person or entity must apply for a Lot
Consolidation to be submitted for review by the Planning Commission and approval by the Board of Trustees.

1. Lot Consolidations are defined as meeting all of the following criteria
   a. Affecting property that was previously subdivided into legally recognized lots or parcels
   b. Not relocating or reconfiguring previously established lot lines
   c. Not resulting in a new lot that had previously been separate lots divided by a public or private road
   d. Not creating or resulting in the creation of a lot or parcel of land that would violate or fail to conform to any applicable zoning or other standard or regulation including, but not limited to, lot area, minimum frontage, building height, setbacks, density, public or private road or private drive standards, parking, or access.
   e. Not altering public right-of-way or easements reserved for drainage or utilities of any kind located on the combined lots

2. Submittal Requirements
   a. The applicant shall provide the following submission materials:
      1. Application Form
      2. Application fee or deposit
      3. Proof of ownership in the form of a deed of title
      4. Project description (narrative) including the following:
         a. Detailed description of lot and block numbers, new location of adjusted lot line with project coordinates, and resulting lot acreages
         b. Detailed description of type, size, and location of existing structures on all lots.
      5. A list of and addresses for all owners of adjacent property and all owners of easements over, through, or across the property.
      6. Lot Consolidation Plat (24" x 34") prepared by a registered land surveyor and drawn to a scale of no less than 1" = 50' (see 12-9-2 (E) and 12-9-11 (K) for specific items)

3. Review Procedures
   a. The Town Planner will have fourteen (14) days from date of submission to determine completeness. Upon acceptance by the Town Planner for submission completeness, the Lot Consolidation request shall be reviewed by the Planning Commission at the next regularly scheduled public meeting. After receipt of recommendation by the Planning Commission,
the Board of Trustees shall review the Lot Consolidation request at their next regularly scheduled public meeting.

4. Review Criteria
   a. The Planning Commission and Board of Trustees shall apply the following review criteria in considering an application
      No application shall be approved unless the Board of Trustees determines that all criteria have been met:
      1. The combined lot(s) are legal lots as defined in section 12-6-8(A)1
      2. The combined lot(s) would not subsequently create additional lots other than the resultant lot(s)
      3. The lot consolidation would not adversely affect existing access, drainage, utility easements, or rights-of-way
      4. The lot consolidation would not adversely affect adjacent properties and the property owners’ enjoyment of their property
      5. Any covenants, deed restrictions, or other conditions of approval that apply to the original lots must also apply to the resultant lot(s)

5. Procedure Following Approval
   a. Where the Board of Trustees has determined that a proposed Lot Consolidation complies with the requirements of these regulations, the Final Lot Consolidation Plat shall be endorsed by the Chair of the Planning Commission and the Mayor of the Town and thereafter the Town Clerk shall file the approved Plat with the Town and with the Grand County Clerk and Recorder.

6. In Perpetuity
   a. Once a Lot Consolidation Plat has been approved, filed, and recorded, the resultant lot(s) are to be considered one (or more) new lot(s), in perpetuity, never to be sold separately or mortgaged separately. Only upon reapplication with the Town to re-subdivide the resultant lot(s) again can these lot(s) be sold or mortgaged separately.

12-6-9 Sales of Subdivision Parts

Whenever any subdivision of land is proposed, before any contract is made for the sale of any part thereof, and before any permit for erection of a structure in such proposed subdivision in accordance with the following procedure, approval of a Final Plat allows sales of the subdivision parts to proceed. In the case of subdivision, the Town of Grand Lake has the right to withhold approval of any Certificate of Occupancy until approval of the As-Built Final Plat by the Town.
12-6-10 Interpretation

The provisions of Land Use Development Standards and Procedures shall be regarded as the minimum requirements for the protection of the public health, safety, comfort, morals, convenience, prosperity and welfare, and shall therefore be regarded as remedial, and shall

Severability: If any Article, Section, paragraph, sentence, clause, or phrase of this Ordinance is held to be unconstitutional or invalid for any reason, such decision shall not affect the validity of the remaining portions of this Ordinance. The Board of Trustees declares that it would have passed this Ordinance and each part or parts thereof irrespective of the fact that any one part or parts be declared unconstitutional or invalid.

Repeal: Existing Ordinances or parts of Ordinances covering the same matters as embraced in this Ordinance are hereby repealed and all Ordinances or parts of Ordinances inconsistent with the provisions of this Ordinance are hereby repealed, except that this repeal shall not affect or prevent the prosecution or punishment of any person for any act done or committed in violation of any Ordinance hereby repealed prior to the taking effect of this Ordinance.

Duly moved, seconded, and approved by the Board of Trustees of the Town of Grand Lake, Colorado, this 11th day of February 2019.

VOTES:  

Votes Approving: 0  
Votes Opposed: 0  
Absent: 0  
Abstained: 0

ATTEST:

_____________________________  ________________________________
Alayna Carrell  
Town Clerk  

James C. Peterson  
Town Mayor

(SEAL)
Date: 2/11/2019

To: Mayor Peterson and Board Trustees
From: TJ Dlubac, AICP, Consulting Planner
       Nate Shull, Town Planner

RE: QUASI-JUDICIAL (PUBLIC HEARING) – Continuation of public hearing on the request for Planned Development (PD) Amendment for the Grand Lake Lodge Planned Development located on property at 15500 US Hwy 34, Town of Grand Lake, CO.

Attachments:
Land Use Application .................................................................
PD Amendment Summary Statement ............................................
PD Amendment Memorandum .......................................................
Revised Traffic Memo Dated Aug. 30, 2018 ..................................
Revised Drainage Report Dated Nov. 30, 2018 ..............................
Phase 1 Environmental Assessment .............................................
Revised Utility Report Revised Date Dec. 21, 2018 .........................
Design/Architectural Guidelines ...................................................
Revised Planned Development Plan Amendment Dated Dec 19, 2018 ...
Narrative on Public Comment Received ........................................
Third Review Comment Memo Dated Nov. 5, 2018 .........................
Bowman Comment Response Memo Dated Nov. 29, 2018 ............... 
Fourth Review Comment Memo Dated Dec. 15, 2018 .....................
Bowman Comment Response Memo Dated Dec. 18, 2018 ............... 
Town Attorney’s Response Memo to MOA and Covenants
       Dated Nov 21, 2018 .............................................................

1) Purpose
The town has received an application from RTA Grand Lake Lodge, LLC requesting to amend the Final Development Plan for Grand Lake Lodge Planned Development. The PD Amendment proposes a four-phased project containing 86 individual lodging units (“cabins”) and associated facilities, internal roadways, and utilities. The PD Amendment requires both Planning Commission and Board of Trustees review.

2) Context
The property is situated south of US Hwy 34, bordering Rocky Mountain National Park (RMNP) to the north and east, and Woodpecker Hill in the Town of Grand Lake to the south. It is accessed by Grand Lake Lodge Rd, which intersects US Hwy 34 just inside the entrance of the Park. The entire area of the property contained within the Grand Lake Lodge PD Plan totals approximately 71.46 acres. The area of the PD Amendment for which specific amendments are being requested and the proposed Site Plan totals approximately 54.4 acres.
3) **Background Information**

**October 22, 2001** – Town Board of Trustees adopted Ordinance No 16-2001, annexing certain lands to the Town of Grand Lake, zoning such annexed property, amending the official zoning map of the Town of Grand Lake, and approving a planned development plan for the Grand Lake Lodge property.

**December 31, 2001** – The PD Plan for the Grand Lake Lodge was recorded with Grand County’s Clerk and Recording Office. The PD Plan established 7 Development Areas, including permitted uses, densities, open space, and specified restrictions within each of these areas and the property as a whole.

**September 21, 2005** – Town Planning Commission signed Resolution No 3-2005, denying an amendment to the PD Plan for the Grand Lake Lodge (predominantly denied because request was submitted by anticipated seller of the property – Estes Park Chalet, Inc. - rather than the future buyer of the property).

**September 26, 2005** – Town Board of Trustees upheld the September 21st Planning Commission decision as documented in Resolution No 3-2005 to deny the amendment request for the Grand Lake Lodge property.

**January 31, 2018** – Town received an application to amend the current PD Plan for the Grand Lake Lodge and a Site Plan proposing development of cabins and associated improvements to the property.

**January 16, 2019** – Planning Commission held a public hearing on the proposed PD amendment and moved to adopt Resolution 02 – 2019, recommending approval of the Final Planned Development Plan Amendment Plan for the Grand Lake Lodge Planned Development with the following conditions:

- An improvement agreement including assurances per Municipal Code section 12-9-11(C)(3)(b) shall be submitted, reviewed, and executed by the Town prior to the Town approving construction documents
- All easements identified as “proposed” are recorded with the Grand County Clerk and Recorder prior to the Amendment being recorded with the Grand County Clerk and Recorder
- Amend Section 3.0 Purpose and Objective of the Design Guidelines to read as follows: *These Design Guidelines are intended to supplement the Design Review Standards under the Building Permit Review Process pursuant to the Town of Grand Lake Code and will be used to insure, as applicable that all improvements, construction, landscaping and alterations of the land conform to these guidelines and harmonize with the natural surroundings and existing structure*
- The applicant shall amend the Design Guidelines to include more active language, where appropriate, with a provision that Town staff may, at its discretion, deem certain guidelines to be less restrictive based on their interpretation to granting flexibility or for the need to comply with modern building, fire, energy, and other related codes.
- The applicant shall amend the Design Guidelines under section 18 to require the first 8' of wall surface to be vertical and under section 25 to require dark-sky lighting as
understood by industry standards.

- The applicant shall obtain a National Park Service Special Use Permit for the installation of required intersection improvements at US Hwy 34 and Old Tonahutu Ridge Rd prior to any certificates of occupancy being issued for structures built in Phase I.
- The applicant shall work diligently with the National Park Service to provide additional fire mitigation efforts and a widened buffer zone within the Rocky Mountain National Park Boundary to the extent possible.
- The applicant shall work diligently with the National Park Service to identify a pedestrian trail on the applicant's property within the 30' setback and will record the necessary public access easement for said trail.

4) **Analysis of PD Amendment Requests:**

PD’s allow flexibility for applicants to create land use, zoning, and development related standards and regulations to meet the unique goals and objectives of the project. Sec. 12-2-25(A) of the Grand Lake Lodge Municipal Code (GLMC) identifies the purpose of a PD.

“[T]he standards and procedures provided in this section are intended to ensure integrated planning goals and objectives with the...comprehensive plan...while allowing greater flexibility and innovations in development and site design than is typically possible under conventional land use regulations.”

The Board of Trustees, in consideration for approval, shall find that all standards and criteria outlined in Sections 12-2-25 (*Regulations for Planned Development – PD*) and 12-9-11 (*Standards*) have been adequately met by the application. The Board may approve, approve with further conditions, or deny the application.

Below is a summary of the PD Amendment requests made by the applicant followed by general analysis of the direct, indirect, and/or potential impact each request may have on the overall development, adjacent properties, the Town of Grand Lake, and the greater Grand Lake community.

5) **PD Amendment Process Overview:**

Sec. 12-9-7(C) of the GLMC outlines the process by which Final Development Plan’s may be amended. Based on the requested amendments, the application was classified as a major amendment requiring a Public Hearing with the Planning Commission and a final decision following a Public Hearing held by the Board of Trustees.

Based on GLMC, requirements, the following documents were required to be submitted to the town in conjunction with the PD Amendment

1. Title Commitment
2. Summary statement of proposal
3. Narrative on Drainage (12-9-7(H)(5)
4. Written documents addressing:
   a. Description of character of proposed development
   b. Development schedule
   c. Description of proposed open space
   d. Proposed covenants

3
c. Statement of applicant’s intentions with future sales/leasing of structures within development
f. Quantitative data
g. Physiographic and environmental studies
h. Traffic impacts
i. Maximum height of buildings
j. Water Rights and/or source of public water supply

5. PD Amendment Drawing including all sheets provided in the initial PDP approved in 2001 indicating proposed amendments.

6) Authority and Scope:
The Board of Trustees shall find all criteria to be met as laid out in Sec. 12-2-25 – Regulations for Planned Development – PD in addition to Articles 12-7 & 12-2, and other sections referenced above. While the authority granted to the Board is wide to include evaluating indirect impacts of a proposal, understanding the specific request is important. In this case, the request is for a PD Amendment. Since this is a rezoning request, the scope of review should be limited to the impacts of uses, and zoning standards. It is also important to understand the subsequent processes required and the scope of those reviews. For example, Construction Documents will be required, therefore, specific construction items will be addressed through that process, not the PD Amendment process.

7) Notification:
Notification was completed in accordance with GLMC requirements including:
1. Notification mailed to Adjacent Property Owners within 200’ of the property and
2. Legal notice published in the newspaper a minimum of 15 days prior to the public hearing.
3. Each Public Hearing constitutes notification for future Public Hearings. Therefore, the February 11, 2019 Board of Trustees public hearing was noticed at the January 16th, 2019 Planning Commission public hearing.

8) General Review Comments:
Sec 12-2-25(G)4(c) of the GLMC requires financial securities to be provided to the town in a sufficient amount to cover on- and off-site public improvements. Even though this is a development which is completely within the bounds of private property, public improvements including, but not limited to, drainage facilities, water utilities, and sewer utilities, are public improvements for which financial assurances shall be required. These improvements will be covered through an Improvement Agreement between the town and the property owner which will identify the approval process for such construction documents, the inspection requirements, acceptance process, and warranty period, and include a phasing plan, a cost estimate, and appropriate form and amount of financial security. This has been stipulated as a condition for approval.

9) Uses:
1. The PD Amendment requests the following changes to the current PDP:
a. **Single-Family Development Area**: No changes are being requested for this area. This area is already developed.

b. **Existing Lodge Development Area**:
   i. Visitor Center added: *This amendment doesn’t appear to impact the overall development significantly as a Visitor’s Center is customarily similar in use to a retail establishment which are allowed within this and other Development Areas.*

c. **Knoll Development Area**:
   i. Up to 21 cabins, classified as a Hotel use, added: *In previous submittals, the Knoll Development Area allowed up to 30 Cabins. The number has been reduced to allow for a more natural layout of the area. This amendment appears to be consistent with other uses in the Development Area.*
   ii. “OR” between each use: *This limits the maximum allowable development within the Development Area.*

d. **Unrestricted Development Area**:
   i. The PD Amendment now identifies this area as “Conservation Easement” and indicates it is encumbered by a Conservation Easement held by the Colorado Headwaters Land Trust comprising 14.1 acres.

e. **Employee Lodge Development Area**:
   i. Up to 29 cabins, classified as a Hotel use, added: *In previous submittals, the Employee Lodge Development Area allowed up to 35 Cabins. The number has been reduced to allow for a more natural layout of the area. This amendment appears to be consistent with other uses in the Development Area. This area additionally allows Employee Housing.*
   ii. The term “Employee Housing” has been removed from the Maximum Units column within the Employee Lodge area as requested by staff. Employee Housing is still an allowed use but does not need to be identified in the Maximum Units column.

f. **Conference Development Area**: No changes are being requested for this area.

g. **James Family Development Area**: No changes are being requested for this area. This area is already developed.

h. **Lake Development Area**:
   i. Up to 36 cabins, classified as a Hotel use, added: *In previous submittals, the Lake Development Area allowed up to 35 Cabins. Although the number has increased, a more natural layout of the area is proposed. Furthermore, while this development area allows one additional unit, the overall development has reduced the overall number of cabins. This*
amendment appears to be consistent with other uses in the Development Area.

ii. “OR” between each use: This limits the maximum allowable development within the Development Area.

10) Dimensional Standards:
The following minimum standards apply to the PDP:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Required</th>
<th>Provided</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Setback</td>
<td>5 ft</td>
<td>30’ minimum</td>
<td>All setbacks are measured from exterior property lines.</td>
</tr>
<tr>
<td>Rear Setback</td>
<td>20 ft</td>
<td>30’ minimum</td>
<td>All setbacks are measured from exterior property lines.</td>
</tr>
<tr>
<td>Side Setback</td>
<td>5'</td>
<td>30’ minimum</td>
<td>All setbacks are measured from exterior property lines.</td>
</tr>
<tr>
<td>Single-Family Floor Area</td>
<td>800sf</td>
<td>N/A</td>
<td>“Cabins” are defined as “Hotels”.</td>
</tr>
<tr>
<td>Multi-Family Floor Area</td>
<td>500sf</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Hotel Floor Area</td>
<td>400sf</td>
<td>560sf - 800sf</td>
<td></td>
</tr>
<tr>
<td>PD Area (Sec. 12-2-25(G)(2))</td>
<td>No minimum required</td>
<td>54.4 acres</td>
<td>All lot lines exceed the 50’ minimum.</td>
</tr>
<tr>
<td>Lot Frontage</td>
<td>50’</td>
<td>Extensive</td>
<td></td>
</tr>
<tr>
<td>Open Space (Sec. 12-2-25(G)(3)(b))</td>
<td>15% x 2,369,664sf (54.4ac) = 355,450sf (8.16ac)</td>
<td>Minimum of 1,522,857.6 sf (34.96 ac) (See Sec. 16.3)</td>
<td>The term “Open Space” has the same definition as the GLMC. Actual Open Space will be calculated through the Building Permit review process.</td>
</tr>
<tr>
<td>Building Height</td>
<td>35’ Maximum</td>
<td>26’ Maximum</td>
<td></td>
</tr>
<tr>
<td>Building Separation</td>
<td>20’ Minimum</td>
<td>20’ between all structures</td>
<td></td>
</tr>
</tbody>
</table>

11) Densities (Sec. 12-2-25(G)(1)):
1. Per Sec. 12-2-25(G)(1) of the GLMC, residential units per acre may be negotiated with the PD Amendment, however, it shall not exceed 1.25 times the existing zoning allowance. The CT Zone District allows up to 2 units per 5,000 sf which allows up to 17.424 units per acre. Multiplying this by 1.25 allows for a maximum density of 21.78 units per acre. At 54.4 acres, a maximum of 1,185 units would be allowed.

2. The Zoning Standards table on Sheet 1 of the 2001 PDP identifies the maximum allowable units within each Development Area. These allowances are identified in the table below.
3. The following table identifies the proposed number of units allowed and the associated densities under the proposed PD Amendment. The far-right column provides the calculated change in density between the original PDP and the proposed amendment. The proposed PD Amendment reduces the overall density on the property by approximately 1.49 unit per acre.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Acreage</th>
<th>Max Units</th>
<th>Density (units per Acre)</th>
<th>Change in Density (units per Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Lodge</td>
<td>14.3</td>
<td>N/A</td>
<td>2.03</td>
<td>N/A</td>
</tr>
<tr>
<td>Knoll</td>
<td>7.7</td>
<td>36 units</td>
<td>4.68</td>
<td>-6.57</td>
</tr>
<tr>
<td>Conservation Easement</td>
<td>14.1</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Employee Lodge</td>
<td>7.2</td>
<td>29 units</td>
<td>4.03</td>
<td>-5.97</td>
</tr>
<tr>
<td>Conference</td>
<td>3.4</td>
<td>30 units</td>
<td>8.82</td>
<td>1.13</td>
</tr>
<tr>
<td>Lake</td>
<td>7.6</td>
<td>36 units</td>
<td>4.74</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>131</strong></td>
<td><strong>2.41</strong></td>
<td><strong>-1.49</strong></td>
<td></td>
</tr>
</tbody>
</table>

12) **Access & Traffic Analysis:**

1. Access to the property is provided by a single access point from US Highway 34 obtained by a Special Use Permit issued by the National Parks Service (NPS) to allow access to the private property through Rocky Mountain National Park. Permit Number IMR-ROMO-GLRD-1802 authorizes a road right of way approximately 24’ by 732’ extending between US Hwy 34 and the Grand Lake Lodge property. This agreement was authorized and executed by both parties in October of 2017 and extends through October 2022.

2. There is an Ingress/Egress and Utility Easement (reception No. 2006010518) along the alignment of Old Tonahutu Ridge Road providing access to the Single-Family and James Family Development Areas to the east of the Grand Lake Lodge property.

3. Secondary emergency access is provided through the south side of the property accessing Perry Street to the south. The access is gated and will be improved with gravel treatment.

4. Internal circulation is offered through a network of privately owned and maintained roads. These roadways should be designed to town street specifications and other applicable town policies and standards. Sec. 12-2-25(G)4 of the GMLC requires that all streets – public and private – be paved and dedicated to the town as utility easements. As described in Development Standard #23 of PDP, Sheet 2 of the PD Amendment depicts specific roadway treatment throughout the project. The main road through the development, Old Tonahutu Ridge Road, and the road leading to the main lodge will be paved while all other roadways will be gravel. Staff supports this request concurrent with Colorado Headwaters Land Trust and Grand Lake Fire Department feedback.

Furthermore, only the main access road (Old Tonahutu Ridge Road) is being depicted as an ingress/egress and utility easement. No other internal roadways have easements over them. In this case, however, this doesn’t appear to have negative impacts because all the
property is under one ownership and there are multiple notes stating that utility easements will be dedicated at the time the Construction Documents are submitted.

5. The applicant has submitted an updated Traffic Memo dated August 30, 2018 which has been reviewed by staff and referral agencies. In summary, the applicant explained that the updated Traffic Memo better incorporates actual traffic counts gathered from July 9th through July 11th of this year. The memo ties these actual counts to the original 2001 traffic study estimates, yielding a net decrease in traffic counts. Based on information provided, town staff believes the following to be true: 1) The NPS has jurisdiction of Highway 34; 2) The traffic memo as presented adequately addresses town code requirements and criteria; and 3) The final design solution of the intersection is to be determined between the NPS and the applicant.

6. The NPS has provided technical comments to the applicant on November 13, 2018 (memo dated October 26, 2018) regarding the Traffic Memo prepared by Bowman Consulting dated August 30, 2018. The memo from NPS identified a number of technical questions and concerns which the applicant has responded to (see memo attached). The applicant and NPS have agreed on installing the turn lanes as part of Phase 1 infrastructure improvements. This is confirmed in the NPS comments dated December 15, 2018 (see attached) and Bowman’s Response Memo dated December 18th (see attached). With this agreement in place, the town will not issue any Certificates of Occupancy for any new structures on the Grand Lake Lodge property prior to the traffic improvements being given initial acceptance by both the town and NPS. These improvements are considered public improvements for which an Improvement Agreement and financial assurances shall be provided per Sec. 12-9-11(C)3(b) of the GLMC.

13) Drainage:
The applicant has submitted an updated Drainage Report dated August 30, 2018 which has been reviewed by staff and referral agencies. An updated Drainage Report was submitted on November 30, 2018. Following a review of that updated Drainage Report, all previous comments have been adequately addressed. Additional information may be provided and reviewed in conjunction with the Construction Documents. Drainage improvements are subject to the parameters of the Improvement Agreement as stated above, including acceptance procedures.

14) Parking:
The PD lays out parking requirements for each development area based on particular uses. The Site Plan identifies the number of parking spaces provided based on those standards. The applicant amended the third submission to remove unique parking standards for this project and simply refer to GLMC parking standards for all uses within the project. Based on these standards, the proposed Site Plan provides adequate parking for the uses. Actual parking space counts will be required to be identified upon the Construction Documents and confirmed through the Building Permit Application review process.

<table>
<thead>
<tr>
<th>Use</th>
<th>GLMC Required</th>
<th>Provided in PD</th>
</tr>
</thead>
</table>

8
15) Utilities:
1. A Utility Plan was submitted and reviewed in conjunction with the PD Amendment and Site Plan applications. The latest version, dated December 21, 2018, appears to meet all requirements for the PD Amendment and Site Plan. Additional information will be provided and reviewed in conjunction with the Construction Documents.

2. Water is provided by the Town of Grand Lake. Service to the property is provided through an existing water main which is brought to the property from the south within the Perry Street right-of-way. Previous comments from the Water Department and Grand Lake Fire Protection District have been adequately addressed for the PD Amendment and the Site Plan approval. Additional review and approval will be necessary through the review of the Construction Documents.

3. Sanitary sewer is provided by Three Lakes Sanitation District. A new 8” sanitary sewer line is proposed to serve the development and replace the existing sanitary sewer lines serving the property. The sanitary sewer line enters the property from the south within the undeveloped Harmon Street right-of-way. The District has approved plans for the property owner to replace the existing sewer line on the property which connects to the south. The current utility easement for the existing sewer line will be vacated and a new 20’ will be provided.

4. New 3-phase electric service is proposed to serve the property. The lines are proposed to be undergrounded within the same utility easement as the sanitary sewer main entering the property from the south. The applicant and property owner are coordination directly with Mountain Park Electric Inc. (MPEI) on the installation of this service.

16) Landscape and Open Space:
1. A Conceptual Landscape Plan is included in the Site Plan packet and includes a Conceptual Plant Schedule. NPS recommended the development of a plant schedule that will strike a balance between native species, fire hazard reduction, and water efficiency. These concerns have been adequately addressed. Final Landscape Plans shall be required to be submitted with building permit applications.

2. Sec. 12-2-25(G)3(b) of the GLMC requires a minimum of 15% of the gross PD Area to be used as Open Space. The total minimum required Open Space area is 8.16 acres (355,450sf). The minimum gross Open Space proposed is 34.96 acres (1,522,857.6 sf), or 64.4%.

3. The PD Amendment uses the same definition of Open Space as stated in Section 12-2-6 the GLMC (See Development Standard 22) including both public and private open space.
a. Public Open Space is defined as “undisturbed, revegetated or improved land dedicated to the common use of the public to provide visual openness and recreation uses.” The 14.1 acre Conservation Easement held by the Colorado Headwaters Land Trust is considered Public Open Space. This easement includes a minimum of a 100’ buffer from adjacent properties to the south. In the original PDP, this area was identified as “Unrestricted Development Area” and only required a minimum of 50% of the 15.6 acres to be open space resulting in approximately 6.3 additional acres of Open Space.

b. Private Open Space is defined as “undisturbed, revegetated or improved land dedicated to the common use of all residents of...mixed-use development which is intended to provide visual openness and recreational use for that development.” Sec. 12-2-6 further identifies Permitted and Non-Permitted uses for Private Open Space. This list shall be consulted through the building permit application review process to ensure adequate and appropriate minimum open spaces are provided.

A minimum open space area is prescribed as a percentage of each Development Area. The proposed PD Amendment does not alter the minimum open space percentages for each Development Area, however, the total acreage changes slightly between the original PDP and the proposed amendment. The table below identifies the percentage and area for each Development Area as well as the difference between the original PDP and the proposed PD Amendment minimum requirements. Overall, approximately 0.48 acres of additional Private Open Space is provided.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Percent Required</th>
<th>Acreage Required</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Lodge</td>
<td>50%</td>
<td>7.15ac</td>
<td>+0.95ac</td>
</tr>
<tr>
<td>Knoll</td>
<td>50%</td>
<td>3.85ac</td>
<td>+0.65ac</td>
</tr>
<tr>
<td>Employee Lodge</td>
<td>50%</td>
<td>3.6ac</td>
<td>-0.15ac</td>
</tr>
<tr>
<td>Conference</td>
<td>50%</td>
<td>1.7ac</td>
<td>-0.25ac</td>
</tr>
<tr>
<td>Lake</td>
<td>60%</td>
<td>4.56ac</td>
<td>-0.72ac</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>20.86ac</strong></td>
<td><strong>+0.48ac</strong></td>
</tr>
</tbody>
</table>

4. The PD Amendment proposes a 30’ building setback from the RMNP boundary. The PD Amendment, as well as the underlying Commercial Transition (CT) zone district requires a minimum of 5’ front and side yard setbacks and a minimum of 20’ rear yard setback. Therefore, the PD meets the town standards associated with setbacks. However, throughout the review, the NPS has requested that the setback be increased to 50’ adjacent to all shared park boundaries. The applicant has provided an analysis of how this increased setback would impact the development in their response letter dated December 18, 2018. That response, along with NPS’s comments, are attached.

*Planning Commission Recommendation – A 30’ boundary setback is adequate. However, the applicant should work diligently with the National Park Service to*
provide additional fire mitigation efforts and a widened buffer zone within the Rocky Mountain National Park Boundary to diminish the impact of the 30’ setback on the applicant’s property to the extent possible.

17) Environmental:
1. Dark sky friendly light fixtures are desired by the town and multiple referral agencies – including NPS. The applicant is also cognizant of dark sky strategies and has expressed an interest in incorporating such standards into the PD Plan. Development Standard #28 requires dark sky friendly lighting to be used throughout the project.

2. With such close proximity to Rocky Mountain National Park, the project will need to be sensitive to wildlife habitats, migration corridors, and other impacts on the park’s natural assets. This may require a number of different strategies. However, the applicant and NPS have expressed an interest in cooperatively working together to mitigate potential negative impacts including using certified soils, developing an invasive species plan, limiting construction activities during times of increased wildlife activities (i.e. migration and mating seasons), and designing the property layout to allow for the flow of wildlife through the property.

3. The applicant has evaluated the soils on the property as requested by Planning Commission, and delineated wetlands on the Site Plan. The wetlands encompass a majority of the Phase IV improvements, including stormwater management facilities (piping and ponds) required for Phase I. Section 12-2-29 of the GLMC requires a minimum of 30’ setback from wetlands. This section also allows for the Planning Commission and Board of Trustees to allow a variance from this setback. A new Development Standard 30 has been added requiring all wetlands to be appropriately mitigated prior to any construction or disturbance of land within the delineated wetland area. These activities will be reviewed to ensure compliance with 12-2-29 through the review of the Construction Documents.

18) Fire Potential and Prevention:
Concerns of wildfires were brought up through discussions with NPS as well as Grand Lake Fire Protection District. While there are currently no applicable regulations or standards associated with wildfire protection or mitigation, the applicant anticipates generally following Fire Wise standards published by the National Fire Protection Association (NFPA). These standards identify three zones based on proximity to homes and/or structures. The first zone is a 30’ no flammable vegetation zone, the second zone extends 100’ and may include fewer trees generally spaced at 15-30 feet, and the third zone extends 300’ from a structure and entails thinning of the vegetation to reduce the forests capacity to sustain a crown fire. As described in the NPS comments dated December 15, 2018 and Bowman Response memo dated December 18, 2018, the applicant will submit a Special Use Permit application to NPS to conduct fire mitigation activities within the park boundaries adjacent to the property to meet the listed fire wise standards.
Planning Commission Recommendation – the applicant should work diligently with the National Park Service to provide additional fire mitigation efforts within the Rocky Mountain National Park Boundary. Were satisfied with plant species proposed to be planted within defensive space/boundary setbacks.

19) Historic District:
The second submission of the PD Amendment and Site Plan was referred to the Colorado State Historic Preservation Office (SHPO) for review and comments were received. However, SHPO was clear in explaining that their office does not have regulatory jurisdiction over the property. The only way they would have increased authority is if federal funding, tax credits, or similar program were used to renovate or remodel the property. With this context, they have provided comments for consideration. The Design Guidelines, updated in the August 30th submission, would regulate the architecture and design of the structures upon the property. These criteria will be applied and enforced in conjunction with all building permit application reviews.

Planning Commission Recommendation – Guidelines should be amended in the following ways:

- Should include more active language, where appropriate, with a provision that Town staff may, at its discretion, deem certain guidelines to be less restrictive based on their interpretation to granting flexibility or for the need to comply with modern building, fire, energy, and other related codes.
- Should require the first 8’ of wall surface to be vertical
- Should require dark-sky lighting as understood by industry standards
- Should require retaining walls be mandated in certain locations based on topography

20) Trails:
There are a number of existing trails that cross the property. Some are social trails which have been created over time through recurring use and others are formal trails open to the general public. Many of the social trails have been identified as being located in the western half of the property. These trails are not formally identified on the PD Amendment nor the Site Plan. A formal trail, the Grand Lake Lodge Trail begins at a trailhead south and east of the property and meanders up the hillside through the conservation easement to the lodge. Additionally, there is a trailhead on the northern edge of the property which provides access to Rocky Mountain National Park from the property. The project is also proposing an internal trail network which will allow guests to walk from one area to another within the property safely. The safety of pedestrians will be further reviewed in conjunction with the Construction Documents to ensure potential conflicts between pedestrians and vehicles are adequately addressed.

Planning Commission Recommendation - the applicant shall work diligently with the National Park Service to identify a pedestrian trail on the applicant’s property within the 30’ setback and will record the necessary public access easement for said trail.
21) Referral Agency Comments:
Request for Formal Referral Agency comments were sent out on the following dates:
➢ April 20, 2018 (1st submission)
➢ July 20, 2018 (2nd submission)
➢ October 15, 2018 (3rd submission)
➢ December 4, 2018 (4th submission)

The following agencies have been provided the first, second, third and/or fourth submission for review:
- Town Water Department
- Xcel Energy
- State Historic Preservation Office
- Town Attorney
- Town Public Works Department
- Town Marina
- Comcast
- Three Lakes Water and Sanitation District
- Grand County 911
- Grand County GIS
- Rocky Mountain National Park (NPS)
- Grand Lake Fire Protection District
- CDOT Region 3 Permit Manager

- Grand County Road and Bridge
- Grand County Assessor
- Grand County Planning Department
- Grand County Sheriff’s Office
- CDOT Region 3 Planner
- Grand Lake Metropolitan Recreation District
- Colorado Headwaters Land Trust
- Arapahoe National Forest Recreation Area
- Mountain Parks Electric, Inc
- Headwaters Trails Alliance
- Century Link
- RG and Associates, LLC

Following the second referral period, the following agencies provided comments:
- Town Water Department
- Town Attorney
- Grand Lake Fire Protection District
- Town Public Works Department
- RG & Associates, Contracted Town Planning and Engineering
- Colorado Headwaters Land Trust
- National Parks Service (Rocky Mountain National Park)
- State Historic Preservation Office

Following the third referral period, the following agencies provided comments:
- RG & Associates, Contracted Town Planning and Engineering
- Colorado Headwaters Land Trust
- National Parks Service (Rocky Mountain National Park)
- Grand Lake Fire Protection District

Following the fourth referral period, the following agencies provided comments:
- RG & Associates, Contracted Town Planning and Engineering
- National Parks Service (Rocky Mountain National Park)
The applicant has been provided a comprehensive comment letter following all reviews. The comment letter sent to the applicant following the third and fourth review have been attached to this staff report.

22. MOA and Covenants
A discussion was held at a public hearing on December 5th, 2018 to address the applicability of two documents known as the Memorandum of Agreement (MOA) and the Covenants, Conditions, and Restrictions of Architecture, Design, and Environmental Control for the Grand Lake Lodge Development (Covenants) to the Applicant’s property. Town Attorney Krob provided the Town a memorandum stating his legal opinion on the matter (see attachment) and subsequently reiterated his opinion during the December 5th meeting. Town staff supports the opinion of Attorney Krob at this time.

23. Adjacent Property Owner & Resident Comments:
Adjacent property owners within 200’ of the Grand Lake Lodge property were notified via mailing of the request. The mailings generated numerous inquiries seeking additional information as well as voicing concerns about potential impacts of the development.

The following individuals reached out to the town during this process seeking additional information of the application:
- Donna Ready
- Gary Casalo
- Elizabeth O’Brien
- Linda Mott
- Patsy & Andy James
- Laura & Jim Peyton
- Dawn Reall
- Don James
- Becky Jones
- Jane Adams
- Nancy McGuffey
- 3 unknown email inquiries

Additional interested members of the public appeared in front of the Planning Commission to express comments, concerns, questions, and impressions of the application at the May 16th, June 6th, July 18th, September 5th, December 5th, and January 16th public hearings on this application. While no action was taken related to the requests those evenings other than continuing the public hearing, public comments were taken and there was a community dialogue on this project.

Over the course of the review of this project so far, general comments received from the public were related to the following items:
- Concerns with increased traffic
- Concerns with increased noise
- Concerns with sanitary sewer backing up
- Desire to increase workforce and affordable housing.
- Concerns of viewshed being disrupted
- Desire to have access to trails
- Questions of whether or not the Lodge will be open year-round.
• Concerns with such a high increase in the number of cabins.
• Questions on the applicability of the MOA and covenants.
• Questions on mitigating wetlands

• Desire to walk the property with the applicant to understand the proposed project.
• Questions on calculating open space
• Questions on PD/Site Plan accuracy and number of cabins that can practically fit on property

A comprehensive list of all questions and concerns brought up was forwarded to the applicant and have been incorporated, as feasible, into the updated proposal.

24. Staff Recommendation:
Staff Recommends the Board approve the PD Amendment with the conditions as stipulated in Planning Commission Resolution 02 – 2019.

25. Public Hearing Procedure:
The public hearing should be conducted as follows:
1. Open the Public Hearing
2. Allow staff to present the matter
3. Allow the applicant to address the Board
4. Take all public comment
5. Close the Public Hearing
6. Have Board discuss amongst themselves
7. Board makes a motion

26. Board Discussion
Provided Staff analysis, applicant’s additional details and public commentary, the Board should discuss the proposal amongst themselves and make a decision.

27. Board Action
The Board has the following options:

Planned Development (PD) Amendment:
1. Approve the PD Amendment for the Grand Lake Lodge Planned Development, as presented, and direct staff to draft a resolution stating this; OR
2. Approve the PD Amendment for the Grand Lake Lodge Planned Development with the following additional conditions ____, and direct staff to draft a resolution stating this; OR
3. Deny the PD Amendment for the Grand Lake Lodge Planned Development, as presented, and direct staff to draft a resolution stating this;
LAND USE REVIEW APPLICATION FORM

APPLICATION DEADLINE IS NOON, 21 DAYS PRIOR TO THE NEXT REGULARLY SCHEDULED MEETING

PROPERTY

- Street Address (or general location if not addressed): 15500 US Highway 34
- Legal Description: Lot — Block — Subdivision —
- Lot Area (in square feet or acres): +/- 47.06 Acres
- Existing Use of Property: Commercial / Lodge

TYPE OF REVIEW (circle one): Rezoning • Subdivision • Map Amendments • Approval • Planned Development
- Conditional Use • Vacation • Public right-of-way • Amendments to approved Subdivision or PD • Other (explain below)

PROPOSAL

Description of Proposal (include proposed use and number and size of units/buildings/lots, as applicable):

This application has been prepared to initiate an amendment to the existing Planned Development Plan for the Grand Lake Lodge property. The proposed amendments shall include the addition of a use and a change in density and open space requirements for the Employee Lodge, Knoll and Lake Development areas.

- Name of Development: Grand Lake Lodge
- Name of Applicant: RTA Grand Lake Lodge, LLC Email: FCorso@rtacq.com
- Address: 2082 Michelleo Drive, No. 4 Phone: (949) 560-4789
- City: Irvine State: CA Zip: 92612 Fax: n/a
- Contact Person (if not applicant): Christopher Perdue Email: CPerdue@Bowmanconsulting.com
- Address: 604 Park Point Drive, Suite 100 Phone: (720) 372-2834
- City: Golden State: CO Zip: 80401 Fax: n/a

STAFF USE ONLY

Application Received By: _______ Date / Time: _______ File Name: _______

Fee Paid: _______ Amount: _______ Reimbursement Form Signed: _______
TOWN OF GRAND LAKE

AGREEMENT FOR FEE OR DEPOSIT PAYMENT ASSOCIATED WITH LAND USE REVIEW AND PROFESSIONAL SERVICES

THIS AGREEMENT ("the Agreement") is entered into this ___ day of November, 2018 by and between the Town of Grand Lake, Colorado, a Colorado municipal corporation, ("the Town") and ______, ______, ______, ______, ______. ("the Applicant").

RECITALS

WHEREAS, the Applicant owns certain property situated in Grand County, Colorado described on Exhibit A, attached hereto and incorporated herein by reference, (the Property"); and,

WHEREAS, the Applicant requests a change in land use for the Property and has made application to the Town for approval; and

WHEREAS, the review and processing include review of all aspects of land use including, but not limited to, subdivision, planned developments, zoning and rezoning, variances, annexation, road vacations, installation of public improvements, dedication of lands and the availability of and feasibility of providing utility services; and,

WHEREAS, in accordance with Ordinance No 16-2016, a fee and deposit schedule was approved by the Board of Trustees establishing fee and deposit amounts for specific land use application procedures from which the Applicant is required to either pay a fee or submit a deposit to cover costs including but not limited to, legal publications, notices, reproduction of materials, public hearing expenses, recording of documents incurred by the Town, as well as any potential engineering fees, surveyor fees, geologist fees, hydrologist fees, landscape architect fees, attorney fees, consultant fees, and fees for administrative time of Town staff, security, permits and assessments; and,

NOW THEREFORE, for and in consideration of the foregoing premises and of the mutual promises and conditions hereinafter contained, it is agreed as follows:

Section 1: Deposit Cost. In accordance with section 12-6-6(B) of the Town of Grand Lake Municipal Code, the Applicant is required to pay a deposit to cover the cost of professional engineering fees, administrative costs, attorney fees, expert consultation fees, and inspection fees in its review of Applicant's land use change ("Project"). The Board of Trustees has determined that the deposit for the legal and administrative undertakings, as well as professional services incurred by the Town shall be $500.00, which amount must be paid in full in cash or certified check to the Town concurrent with the completion of this agreement.

Section 2: Accounting of Deposit. The Town will keep track of the professional costs incurred by the Town in the review of Applicant's Project. Monthly
statements of professional service expenses incurred by The Town will be made available to the Applicant. Should the costs exceed the amount of the deposit, The Town shall promptly notify the Applicant who shall within ten (10) days of the date of the notification, submit in full additional funds in the amount determined by the Town.

Section 3: Completion of Review. Upon completion of its review and determination of the costs of all professional services, The Town shall provide a final invoice to the Applicant. The Town shall either refund the Applicant any amount of the deposit that was not expended by the Town, or request the Applicant reimburse the Town for the additional expenses and fees noted in the invoice.

Section 4: Payment of Invoice Required. Applicant shall pay all invoices submitted by the Town within ten (10) days of the Town’s delivery of such invoice. Failure by the Applicant to pay any invoice within the specified time shall result in immediate suspension of the issuance or granting of any building permits, certificates of occupancy or other Town approvals. Additionally, the Town may exercise such rights and remedies as are otherwise available to it in law or equity or under the applicable provisions of the Town Code.

Section 5: Application Early Termination. Except where the law or an agreement with the Town provides otherwise, the Applicant may terminate its application at any time by giving written notice to the Town. The Town shall take all reasonable steps necessary to terminate the accrual of costs to the Applicant and promptly refund any remaining deposit balance. The Applicant shall be liable for all costs incurred by the Town in terminating the processing of the application.

Section 6: Collection of Costs and Remedies. If the Applicant fails to pay the Town the cost of any professional service within the specified time periods set forth herein, the Town may take those steps necessary and authorized by law to collect the fees and costs due, in addition to exercising those remedies set forth in Section 4, above. The Town shall be entitled to all costs incurred, including attorney’s fees in collection of the balance due, including interest on the amount due from its due date at the rate of 18% per annum.

Section 7: Payment of Cost Independent. Applicant’s obligation to pay costs and expenses provided for in this Agreement shall exist and continue independent of whether the Owner’s application, or any part thereof, is approved, approved with conditions, denied, withdrawn, or terminated by the Town or the Owner prior to a final decision in the process.

Section 8: Miscellaneous

Section 7.1 Colorado Law: This Agreement is to be governed by the laws of the
State of Colorado. Venue for any litigation shall be in the District Court, County of Grand, State of Colorado.

Section 7.2 Amendments: This Agreement may only be amended, supplemented or modified in a written document executed by both parties.

Section 7.3 Counterparts. This Agreement may be executed in two or more counterparts, using manual or facsimile signature, each of which shall be deemed an original and all of which together shall constitute one and the same document.

Section 7.4. Severability: If any term, covenant, or condition of this Agreement is deemed by a court of competent jurisdiction to be invalid, void or unenforceable, the remaining provisions of this Agreement shall be binding upon the parties.

Section 7.5. Entire Agreement: This Agreement constitutes the entire agreement between the parties and supersedes all other prior and contemporaneous agreements, representations, and understandings of the parties regarding the subject matter of this Agreement. No supplement, modification, or amendment of this Agreement shall be binding unless executed in writing by the parties. No representations or warranties whatever are made by any party to this Agreement except as specifically set forth in this Agreement or in any instrument delivered pursuant to this Agreement.

Section 7.6. Default/Attorney’s Fees: In the event of default of any of the provisions herein, the defaulting party shall be liable to the non-defaulting party for all reasonable attorney fees, legal expenses and costs incurred as a result of the default.

Section 7.7. No Waiver: Delays in enforcement or the waiver of any defaults of this Agreement by either party shall not constitute a waiver of any of the other terms or obligations of this Agreement.

IN WITNESS WHEREOF, The Town and the Owner have caused this Agreement to be duly executed on the day and year first above written.

TOWN OF GRAND LAKE
By: [Signature]
Name: Nathaniel Shull
Title: Town Planner

ATTORNEY
By: [Signature]
Name: Alayna Carroll
Title: Town Clerk

APPLICANT
By: [Signature]
Name: Tom Gable
Beulah Consulting
RECEIPT

DATE 01/31/18
NO. 1707

RECEIVED FROM Big Valley Construction, LLC

ADDRESS P.O. Box 1879
Granby, CO 80446 $ 500.00

FOR Land Use Review

ACCOUNT # 9670

AMT. OF
ACCOUNT 500.00

AMT. PAID

BALANCE DUE

CASH

CHECK

MONEY ORDER

BY A.S.
March 30, 2018

Town of Grand Lake
P.O. Box 99
Grand Lake, CO 80447-0099
Attention: Nate Shull

Re: Grand Lake Lodge
Planned Development Plan Amendment Summary Statement of Proposal

Dear Nate,

Thank you and your team for taking the time out recently to discuss our development teams new and exciting plans to re-vitalize the Grand Lake Lodge. As we’ve discussed, the current ownership group is committed to constructing new water, electric and sanitary sewer infrastructure necessary to meet their current utility demands as well as a new managers unit and visitor’s center. In addition to completing these improvements, the development team is also evaluating option(s) for constructing rental cabins in the Employee Lodge, Lake and Knoll Development areas depicted in the Planned Development Plan (PDP) dated November 2001.

These improvements lie within the allowable uses outlined in the Planned Development and Commercial Transitional Zoning Districts applicable to the Grand Lake Lodge property with exception of the rental cabins. As such, our team would like to work with the Town of Grand Lake to amend the allowable use(s) and density requirements in the existing PDP to permit construction of these rental units. The following paragraph’s outline the proposed amendments necessary to plan and construct the Project. It should be noted that all amendments will specifically apply to the Employee Lodge, Lake and Knoll Development areas and no edits are proposed to any development area boundaries.

Allowable Uses

Term and provision items 1 through 7 of the existing PDP outlines the specific uses for each development area. Allowable uses listed in each of the three (3) subject areas primarily align with uses permitted “by-right” within the Commercial Transitional Zone per Paragraph 12-2-17 (A) of the Town’s Zoning Regulations. Our review of Paragraph 12-2-6 – Definitions, indicate that rental cabins will be considered “nightly rentals” which are considered “by right” with a conditional use permit in the Commercial Transitional Zone. Zoning Regulation Paragraph 12-2-25 (D) states “all uses that are uses permitted by right according to the zone district applicable to the property prior to approval of the Planned Development application shall be permitted in the Planned Development”. With that said, we would like to amend term 1 to include “nightly rentals” in the list of allowable uses in the Employee Lodge, Lake and Knoll Development areas.

Additionally, over the 17 years following approval of the PDP the lodge has taken steps to increase the available living quarters for employees. Term 1 requiring construction of 75 units for employee housing is outdated and does not allow for fluctuations in the number of staff the lodge employees at any given time. As such, we request that the requirement for constructing 75 units for employee housing be removed from Term 1. Through remodels and such, the lodge provides living quarters
on-site for approximately 88 employees today. None of those facilities are located within the Employee Lodge Development area. Term 12, "the Lodge shall provide housing for seventy-five percent (75%) of its employees" should be adequate regulation to ensure that the Lodge provides sufficient housing for employees.

Density

As part of the PDP Amendment, our team also proposes to amend the allowable densities within the three (3) subject development areas. Based on the number of units allowed by the existing PDP within each development area, the following densities can be determined.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Maximum Units</th>
<th>Total Area</th>
<th>Current Max Density</th>
<th>Requested Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee Lodge</td>
<td>75 (employee housing)</td>
<td>7.5 acres</td>
<td>10 units/acre</td>
<td>5 units/acre</td>
</tr>
<tr>
<td>Lake</td>
<td>36 (multi-family)</td>
<td>8.8 acres</td>
<td>4 units/acre</td>
<td>5 units/acre</td>
</tr>
<tr>
<td>Knoll</td>
<td>36 (multifamily)</td>
<td>6.4 acres</td>
<td>6 units/acre</td>
<td>5 units/acre</td>
</tr>
</tbody>
</table>

Per Paragraph 12-2-17 (D)7 of the Town’s Zoning Regulations, the allowable density for the Commercial Transitional Zone “shall not exceed two (2) units per 50’x100’ lot”. This equates to a maximum density of 17.42 units per acre. Given the existing topography, area configuration and vehicular access to be provided throughout each development area, we request that the PDP be amended to allow a maximum density of 10 units per acre.

Per Zoning Regulation Paragraph 12-2-25 (F)1 pertaining to Planned Development Density’s, “in no case shall the density exceed 1.25 times the density of the existing zone overlay”. Given a maximum density of 17.42 units per acre in the Commercial Transitional Overlay Zone, 5 units per acre as proposed will align with the overall purpose(s) of the Planned Development Zone and will maximize the developable area within each area while maintaining open space requirements.

Open Space

The current PDP specifies open space requirements of 50, 50 and 60 percent for the Employee Lodge, Knoll and Lake Development areas, respectively. To develop these areas at the densities requested above, providing fifty (50%) to sixty (60%) percent open space is not feasible. Paragraph 12-2-25 (G)3(b) of the Planned Development Zoning Regulations states “open space in a commercial Planned Development shall, at a minimum, be provided by and as consistent with these Zoning Regulations or a minimum of fifteen percent (15%) of the gross commercial PD land area. The Commercial Transitional Zone does not specifically define the percentage of open space required. Given the proposed development plan and the applicable zoning regulations, we propose to amend the open space requirements within all three development areas to forty percent (40%).

As evidenced by the attached redlines on the existing PDP, the requested revisions are minor in nature and are not intended to alter the overall use of the entire property. The proposed rental cabins will be designed and constructed of materials that maintain consistency throughout the viewshed. Should the Commission conceptually agree to these suggested amendments, our team intends to prepare a formal Site Plan package depicting the general unit arrangement within the

Bowman Consulting Group, Ltd.
603 Park Point Drive • Suite 100 • Golden, Colorado 80401 • P: 303.674.7355 • F: 303.674.3263
P.O. Box 679 • 135 E. Jasper Avenue • Granby, Colorado 80446 • P: 970.887.2600 • F: 970.887.3200
bowmanconsulting.com
three development areas, architectural elevations of the cabins and horizontal location and sizes of infrastructure necessary to serve the Lodge upon completion of the full build out.

I trust that the information contained herein is adequate to represent our intentions. Should you require any clarification or additional information, please feel free to contact me at (720) 372-2834.

Sincerely,

Bowman Consulting Group

Christopher L. Perdue, P.E., M.B.A.
Team Leader/Senior Project Manager
CPerdue@bowmanconsulting.com
Memorandum

To: Nathaniel Shull
From: Christopher Perdue, P.E., M.B.A.
Date: 4/1/2018
Re: Grand Lake Lodge PD Amendment

Description of Character of Proposed Development

Grand Lake Lodge is currently one of the main attractions located in the Town of Grand Lake. Grand Lake offers a wide range of outdoor activities including hiking, fishing, mountain biking, boating and many other outdoor activities. In addition, the Lodge is a popular destination for dining, weddings and family getaways.

The intent of this project is to expand on the overall experience visitors receive at the Lodge. Being a family and recreational oriented destination situated in the Rocky Mountains, the cabin expansion will maintain consistency with the existing facilities. Each cabin will utilize natural wood and colors emphasizing the Lodge’s connection to the outdoors. Structures will be constructed in locations that maximize views of Grand Lake. The manager’s unit, visitor center and amenity areas will also be constructed with materials that create the look and feel of one destination. Outdoor recreation will also be provided within the cabin expansion area including volleyball courts, picnic areas and a swimming pool.

Development Schedule

The following table outlines the milestones for completing construction of each phase of the proposed development plan.

<table>
<thead>
<tr>
<th>Milestone Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approval of Planning Documents</td>
<td>May 22nd, 2018</td>
</tr>
<tr>
<td>Phase IA Construction (10 units)</td>
<td>September, 2018</td>
</tr>
<tr>
<td>Phase IB Construction (22 units)</td>
<td>September, 2019</td>
</tr>
<tr>
<td>Phase II Construction (41 units)</td>
<td>September, 2020</td>
</tr>
<tr>
<td>Phase III Construction (8 units)</td>
<td>September, 2021</td>
</tr>
<tr>
<td>Phase IV Construction (10 units)</td>
<td>September, 2022</td>
</tr>
</tbody>
</table>

Description of Open Space

Open space will be preserved to the extent possible as part of the development. As outlined in the Description of Character, a natural setting complimented by existing vegetation is key to creating the outdoor appeal of the Project.

Proposed Covenants

There are no proposed covenants associated with this Planned Development Plan Amendment.
Statement of Applicant’s Intentions with Future Sales/Leasing of Structures Within Development

The proposed cabins that are facilitating this amendment to the Planned Development Plan will be owned and operated by the existing lodge owner and rented to the public. Given the project will be commercial in nature, the owner has no intention to lease or sale any of these structures.

Quantitative Data

Quantitative Data has been provided on the Cover Sheet of the Planned Development Plan Amendment and the Site Plan.

Maximum Height of Buildings

The maximum building height for new structures within the subject property shall not exceed thirty-five (35) feet.

Water Rights and/or Source of Public Water Supply

The Project will be served with Public Water Supplied by the Town of Grand Lake. Our team will submit a request for water service necessary to accommodate the overall development plan to the Town. A Utility Report has been included as part of this submittal demonstrating the required flow demands.
Memorandum

To: Nate Shull, Town Planner

From: Tim Gagnon P.E.

Date: 08/30/18

Re: Grand Lake Lodge Updated Traffic Analysis

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Overall Description

Grand Lake Lodge is currently one of the main attractions located in the Town of Grand Lake. Grand Lake offers a wide range of outdoor activities including hiking, fishing, mountain biking, boating and many other outdoor activities. In addition, the Lodge is a popular destination for dining, weddings and family getaways.

The intent of this project is to redefine the existing land uses in the current Planned Development Plan (PDP) from 2001 and develop a site plan that enhances the experience visitors receive while at the Lodge. Being a family and recreational oriented destination situated in the Rocky Mountains, the cabin expansion will maintain consistency with the existing facilities. A manager’s unit, welcome center and remodeled amenity areas will also be constructed to support the expanded lodging. This memorandum has been prepared to address traffic impacts on-site at the Old Tonahutu Ridge Road and US Highway 34 (Trail Ridge Road) intersection.

Site Characteristics

The current PDP from 2001 contained eight individual development areas, each defined with specific land uses, boundaries, open space and densities. The new/proposed Planned Development Plan includes updates to three of these development areas. The proposed cabins will be constructed in these three areas and will include 86 cabins (75 single-story & 11 two-story). No other revisions to the other five development areas are anticipated. Overall the proposed densities are less than those approved in 2001.

The whole site is accessed by Old Tonahutu Ridge Road, with a posted speed of 15mph and intersects with Highway 34 (Trail Ridge Road), a two-lane highway with a minor arterial CDOT functional classification and a posted speed of 40 MPH. Utilizing CDOT’s online traffic information, the highway has an average annual daily traffic of 4500. The referenced intersection is located on National Park Service property and the special permit (IMR-ROMO-GLRD-1802) grants access through the National Park to the referenced site. Currently there are no auxiliary lanes located at this intersection and although the analysis below was done using CDOT auxiliary lane warrants the National Park Service will ultimately have jurisdiction.

Using AASHTO “Policy on Geometric Design of Highway and Streets” – table 9-6, the required sight distances for a 40mph posted speed road are 445’ for a left turn exiting the site and 385’ for a right turn exiting the site. As shown on Figure 1, the sight distances are adequate for the existing intersection.

Existing Traffic Study

A traffic study was completed by TranSystems (dated March 14, 2001) for the Planned Development Plan from 2001 that utilized the proposed land uses in all eight development areas to estimate existing and future traffic volumes. Below are estimated traffic volumes and conclusions from this study:
• The estimated Average Daily Trips (ADTs) for the current development (2001) were estimated at 1,316, with an estimated PM peak-hour volume of 125 vehicles.
• The estimated ADTs for future development (2020) were estimated at 2,132, with an estimated PM peak-hour volume of 202 vehicles.
• The following land uses types and unit counts were used to calculate these traffic volumes:
  o Existing Restaurant
  o 120 Hotel Rooms – Cabins
  o 48 Residential Condos-Townhomes
  o 23 Single-Family Units
  o 14 Apartments
• Based on current adjacent land uses and CDOT traffic data, 30% of the traffic demand is from the north and 70% is from the south.
• Additional turn lane (northbound right and southbound left) are warranted on US34 pursuant to the CDOT State Highway Access Code.
• Although the lanes are warranted, our analysis shows that the intersection LOS continues to function at an acceptable level (LOS A).

Trip Generation

Densities and land uses in three of the development areas are being revised from the 2001 PDP, requiring that traffic volumes are updated from the existing traffic study from TranSystems. Using the ITE Trip Generation Manual (9th Edition), and the proposed land uses, PM peak-hour traffic volumes were updated and tabulated for both existing conditions and at full buildout (reference Attachment ‘A’). The PM peak hour was selected for analysis because the primary trip generation (resort hotel and restaurant) have much lower trips in the AM peak hour. Also based on traffic counts from CDOT on the adjacent section of highway, the PM peak hour traffic is generally 50% greater than the AM peak hour.

The only reduction in trips is within the existing lodge development area, 30 of the 100 rooms in the lodge are used as employee housing and were decreased to zero trips because most employees do not have a vehicle on site and do not generate any trips during the peak hour of business.

A 1.25% annual growth rate (from previous study) was attributed to existing land uses to develop future traffic volumes for these uses.

The PM peak-hour volumes for the current development (2018) were estimated at 94 vehicles.

The PM peak-hour volumes for full-build-out of the proposed development were estimated at 174 vehicles.

Traffic Counts

Traffic counts were taken at the intersection of Old Tonahutu Ridge Road and Highway 34 during the late afternoon to determine actual PM peak-hour volumes and to verify the traffic volumes calculated using the ITE Trip Generation Manual (9th Edition). These traffic counts were manually input based on visual observation of traffic flow from 4:00pm to 7:00pm from July 9, 2018 thru July 11, 2018 (Monday-Wednesday) and are tabulated in Attachment ‘B’.

The week these counts were taken is the peak season in Grand Lake and generally represents one of the busiest weeks of the entire year, with traffic volumes likely somewhere near the 30th highest annual peak hour volumes.

The average peak-hour volume during these three days of counts was 96 vehicles.

Directional Distribution

The directional distributions were assumed to be 43% northbound and 57% southbound trips which matches CDOT’s directional distribution in this section of Highway 34, adjacent to the access. The traffic was analyzed in the existing and proposed conditions and tabulated below.
### Table 1 – PM Peak Hour Directional Distribution

<table>
<thead>
<tr>
<th>Use</th>
<th>Directional Distribution</th>
<th>Movement Required</th>
<th>Total Enter Site (From Attach ‘A’)</th>
<th>Total Exit Site (From Attach ‘A’)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Northbound</td>
<td>Southbound</td>
<td>Entering</td>
<td>Exiting</td>
</tr>
<tr>
<td>Existing</td>
<td>43%</td>
<td>57%</td>
<td>23</td>
<td>31</td>
</tr>
<tr>
<td>Future</td>
<td>43%</td>
<td>57%</td>
<td>40</td>
<td>52</td>
</tr>
</tbody>
</table>

### Auxiliary Turn Lane Analysis

Turn lane warrants and analysis are depicted in the State of Colorado – State Highway Access Code, Volume 2, March 2002. Table 2 below shows that both a right turn and left turn deceleration lanes are warranted based on CDOT requirements in the existing and future traffic conditions.

<table>
<thead>
<tr>
<th></th>
<th>CDOT PHV Minimum</th>
<th>Existing PHV</th>
<th>Proposed PHV</th>
<th>Existing Aux. Lane?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Turn (Exiting Lodge) – Accel</td>
<td>N/A*</td>
<td>23</td>
<td>47</td>
<td>No</td>
</tr>
<tr>
<td>Right Turn (Exiting Lodge) - Accel</td>
<td>50</td>
<td>17</td>
<td>35</td>
<td>No</td>
</tr>
<tr>
<td>Left Turn (Entering Lodge) - Decel</td>
<td>10</td>
<td>23</td>
<td>40</td>
<td>No</td>
</tr>
<tr>
<td>Right Turn (Entering Lodge) – Decel</td>
<td>25</td>
<td>31</td>
<td>52</td>
<td>No</td>
</tr>
</tbody>
</table>

PHV = Peak hour volume
* Posted speed less than 45mph, not required (from CDOT access permit requirements)

### Table 2 – Auxiliary Turn Requirements at Buildout

It should be noted that the requirements in the CDOT State Highway Access Code are generally developed for normal travel speeds on the majority of their highways (65 MPH). Because this portion of Highway 34 has a posted speed limit about 25 MPH less than the highway speeds generally used to develop their standards, many of the minimum turning volume warrants from CDOT may not be as applicable or as necessary to minimize intersection delays and to maintain safe intersection operations.

### Comparison of Reports and Traffic Volumes

The following is a summary of the existing and proposed PM Peak-Hour Traffic Volumes for both traffic studies and for the existing traffic counts recently completed:
August 30, 2018

<table>
<thead>
<tr>
<th>REPORT/COUNT</th>
<th>EXISTING VOLUMES</th>
<th>FUTURE VOLUMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TranSystems - 2001</td>
<td>125</td>
<td>205</td>
</tr>
<tr>
<td>Bowman - 2018</td>
<td>94</td>
<td>174</td>
</tr>
<tr>
<td>Ave. Traffic Counts - 2018</td>
<td>96</td>
<td>n/a</td>
</tr>
</tbody>
</table>

The existing traffic volumes from this 2018 report appear to better match the actual traffic counts than the TranSystems report from 2001.

The proposed traffic volumes from this 2018 report are lower than the future traffic volumes predicted in the 2001 report, which is due to the decrease in proposed densities from the original 2011 PDP.

**Level of Service**

Based on the results of the 2001 Traffic Study which depicted an overall LOS of ‘A’ for the intersection based on future traffic volumes and the fact that that the updated future traffic volumes predicted in this report are less than the future traffic volumes from the 2001 study, it is our conclusion that an update to the LOS calculations from the 2001 study is not necessary, and that the LOS ‘A’ will continue to be applicable for this intersection with future traffic volumes. Additional LOS descriptions and explanations are included in the original report and specifies a LOS ‘A’ as being the most desirable rating with minimal traffic delays anticipated at the intersection.

**Conclusion**

- The estimated traffic volumes within this study are based on trip generation rates from the Institute of Transportation Engineers (ITE) and further verified by on-site traffic counts recorded in the peak hour (see attachment ‘B’).
- Based on the results of this study a left and right deceleration lane would be warranted under CDOT guidelines, but as discussed above these CDOT warrants may not be applicable for a lower speed highway like Highway 34, and this intersection is ultimately governed by the National Parks Service.
- Based on results of the original traffic study the intersection is anticipated to maintain an overall Level-of-Service of ‘A’.
- It is the applicants understanding that the National Parks Service and the Town of Grand Lake originally reviewed the traffic study from 2001 and did not require the Lodge to install highway auxiliary turn lanes.
- The proposed densities from the proposed PD and the associated future traffic volumes are less than those depicted in the 2001 PDP and 2001 traffic study.

**Figure 1 – Right & Left Sight Distances**

![sight_distance_image]
### Development Area

<table>
<thead>
<tr>
<th>Development Area</th>
<th>#</th>
<th>Existing PM Peak Hour</th>
<th>Future PM Peak Hour</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Development Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(210) Single Family Detached (Avg. Rate = 1.00)</td>
<td>19 Lots</td>
<td>12 7 19</td>
<td>15 9 24</td>
<td></td>
</tr>
<tr>
<td>(63% Entering / 37% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Lodge Development Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(330) Resort Hotel (Avg. Rate = 0.42)</td>
<td>70 Rooms</td>
<td>12 18 30</td>
<td>15 23 39</td>
<td>See Note 1</td>
</tr>
<tr>
<td>(40% Enter / 60% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(220) Apartment (Avg. Rate = 0.62)</td>
<td>30 Rooms</td>
<td>0 0 0</td>
<td>0 0 0</td>
<td></td>
</tr>
<tr>
<td>(65% Entering / 35% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(931) Quality Restaurant (Avg. Rate = 7.49)</td>
<td>6,000 Sq. Ft.</td>
<td>30 15 45</td>
<td>39 19 58</td>
<td></td>
</tr>
<tr>
<td>(6.7% Entering / 33% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knoll Development Area</td>
<td>(330) Resort Hotel (Avg. Rate = 0.42)</td>
<td>32 Rooms</td>
<td>5 8 13</td>
<td></td>
</tr>
<tr>
<td>(40% Enter / 60% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestricted Development Area</td>
<td>No Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Lodge Development Area</td>
<td>(330) Resort Hotel (Avg. Rate = 0.42)</td>
<td>29 Rooms</td>
<td>5 7 12</td>
<td></td>
</tr>
<tr>
<td>(40% Enter / 60% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conference Development Area</td>
<td>(591) Lodge / Fraternal Organization</td>
<td>9,000 GFA</td>
<td>0 0 0</td>
<td>See Note 2</td>
</tr>
<tr>
<td>(50% Entering / 50% Existing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(330) Resort Hotel (Avg. Rate = 0.42)</td>
<td>30 Rooms</td>
<td>5 8 13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(40% Enter / 60% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>James Family Development Area</td>
<td>(210) Single Family Detached (Avg. Rate = 1.00)</td>
<td>2 Units</td>
<td>1 1 2</td>
<td></td>
</tr>
<tr>
<td>(6.3% Entering / 37% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(230) Residential Condo/Townhouse (Avg. Rate = .52)</td>
<td>6 Units</td>
<td>2 1 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6.7% Entering / 33% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake Development Area</td>
<td>(330) Resort Hotel (Avg. Rate = 0.42)</td>
<td>25 Rooms</td>
<td>5 6 11</td>
<td></td>
</tr>
<tr>
<td>(40% Enter / 60% Exiting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Most employees are seasonal and do not own vehicles. It is assumed that employee housing does not generate any peak hour trips.
2. All conference trips are assumed to be internal and users on site.
### ATTACHMENT 'B'

**Existing traffic count - Intersection of Trial Ridge Road (Hwy 34) & Old Tonahutu Ridge Road**

**9-Jul**

<table>
<thead>
<tr>
<th>Time</th>
<th>Max Hour</th>
<th>Left Turn - Exit</th>
<th>Right Turn - Exit</th>
<th>Left Turn - Enter</th>
<th>Right Turn - Enter</th>
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<tbody>
<tr>
<td>4:00 PM</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>4:15 PM</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4:30 PM</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4:45 PM</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5:00 PM</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5:15 PM</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5:30 PM</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5:45 PM</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6:00 PM</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6:15 PM</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6:30 PM</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0</td>
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<tr>
<td>6:45 PM</td>
<td>40</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>40</td>
</tr>
</tbody>
</table>

**Total** 20 16 20 17 18 24 24 13 14 23 15 25 84

**10-Jul**

<table>
<thead>
<tr>
<th>Time</th>
<th>Max Hour</th>
<th>Left Turn - Exit</th>
<th>Right Turn - Exit</th>
<th>Left Turn - Enter</th>
<th>Right Turn - Enter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00 PM</td>
<td>10</td>
<td>5</td>
<td>7</td>
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<td>1</td>
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<td>1</td>
</tr>
<tr>
<td>4:45 PM</td>
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<td>1</td>
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<td>1</td>
</tr>
<tr>
<td>5:00 PM</td>
<td>13</td>
<td>13</td>
<td>12</td>
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</tr>
<tr>
<td>5:45 PM</td>
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</tr>
<tr>
<td>6:00 PM</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>6:45 PM</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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</tr>
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</table>

**Total** 30 18 27 20 23 30 18 23 21 25 8 19 100

**11-Jul**

<table>
<thead>
<tr>
<th>Time</th>
<th>Max Hour</th>
<th>Left Turn - Exit</th>
<th>Right Turn - Exit</th>
<th>Left Turn - Enter</th>
<th>Right Turn - Enter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00 PM</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>4:15 PM</td>
<td>12</td>
<td>12</td>
<td>16</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>4:30 PM</td>
<td>12</td>
<td>12</td>
<td>16</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>4:45 PM</td>
<td>12</td>
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<td>7</td>
<td>1</td>
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<tr>
<td>5:00 PM</td>
<td>12</td>
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<td>1</td>
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<td>5:15 PM</td>
<td>12</td>
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<tr>
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<td>9</td>
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</tr>
<tr>
<td>6:45 PM</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

**Total** 17 23 20 40 19 27 20 16 21 16 10 106
Response to the Bowman Memorandum

To: Sena Wiley, Intermountain Region Roads Coordinator
From: Robert Gansauer, Transportation Engineer, Denver Service Center
Date: 26 October, 2018
Re: Turn Lane Analysis at Grand Lake Lodge

I have reviewed the Memorandum from Tim Gagnon, P.E. (Bowman Consulting) dated 30 August, 2018, that discusses the traffic analysis and potential turn lanes at the intersection of US Highway 34 (Trail Ridge Road) and Old Tonahutu Ridge Road (which accesses the Grand Lake Lodge complex).

Per the individual sections of the Memorandum, I have the following comments:

**Overall Description:** No comments

**Site Characteristics:** The second paragraph states that the posted speed limit is 40 mph. The third paragraph then cites the AASHTO “Policy on Geometric Design of Highway [sic] and Streets” (the Green Book) and refers to Table 9-6 for intersection sight distances for both left and right hand turns. Table 9-6 is for left turns and Table 9-8 is for right hand turns. The analysis in the Memorandum uses the 40 mph posted speed as the basis for the sight distances. However, both tables are based on design speed, not the posted speed. The design speed is higher than the posted speed, and more research into the design of US 34 would be needed to determine the design speed. It would also help to know what the average running speed is. For about 2200 feet north of the intersection, southbound traffic on US 34 is traveling on a 4.5% downhill grade. Assuming a running speed of 50 mph, the required sight distance per Table 9-6 would be 555 feet. The length of this sight distance is difficult to determine from aerial photography as there are some trees, a wayfinding sign, and a cut slope on the right side of the southbound lane of US 34. A field measurement of various sight distances should be made.

**Existing Traffic Study:** This section compares current traffic volume figures with figures from a study that was performed in 2001. The next to the last bullet point in this section states that additional turn lanes are warranted “pursuant to the CDOT State Highway Access Code”. The last bullet point then states that (I assume without the turn lanes and based on volume) the intersection would continue “to function at an acceptable Level of Service, (LOS A).” Sight distances and protected turn lanes are safety issues as well as level of service issues.

**Trip Generation:** The conclusion of the second paragraph, decreasing the trips of employees of the site to zero, is questioned. It may not add substantially to the any total, but the total for that group is probably not zero.

**Traffic Counts:** Traffic data is scanty, and data collected specifically for the Memorandum is as well, most likely due to the schedule for the delivery of the Memorandum. Traffic data was collected over 9 – 11 July (Monday – Wednesday), “one of the busiest weeks of the entire year”, from 4:00 pm to 7:00 pm.
Why were counts not also taken for three hours in the morning (on say, a Sunday) when guests are leaving the Lodge property? Why were afternoon counts not taken later in the week? Is the occupancy rate of the premises the same on Mondays as on Thursdays or Fridays? Also, there may be other times—just before dusk on the 4th of July, for example—when there may be quite a bit of traffic exiting the Lodge property.

**Directional Distribution:** No comment as to the numbers, but if 57% of the traffic on US 34 is southbound, and over half of the traffic exiting the Lodge property is turning left, then the analysis should be reconsidered based on the running speeds on US 34 and field verified sight distances.

**Auxiliary Turn Lane Analysis:**
The Memorandum states that per the State of Colorado State Highway Access Code that both right and left turn deceleration lanes are warranted. Therefore, it is hard to understand the disclaimer in the second paragraph.

**Level of Service:**
As stated above, the turn lane and sight distance questions at the intersection are not only Level of Service or congestion/delay issues.

**Conclusion:**
Per the second bullet point, it is implied that although turn lanes are required by CDOT, they may not be necessary because the “intersection is governed by the National Parks [sic] Service”. The geometrics of US 34, the location of the intersection, and the physics of vehicles traveling at speed are the criteria that are being evaluated, not the ownership of the road.

My response to the Bowman Memorandum is as follows:
Determine the actual running speeds of traffic on US 34, especially southbound traffic as it is descending a grade of approximately 4.5%.

Use the actual running speeds to determine the required intersection sight distances based on Tables 9-6 and 9-8 of the Green Book.

Determine sight distances for left turns exiting the Lodge property in the field. Also examine the right turn sight lines and distances as there appear to be trees and a wayfinding sign that may interfere with the sight distance.

Understand that the State Highway Access Code provides code requirements and not design guidelines as the Green Book does.

Contact the Park Police, the Grand Lake Police, and the Grand County Police Departments for records of accidents at the intersection.
PHASE III DRAINAGE REPORT
FOR
GRAND LAKE LODGE
15500 US HIGHWAY 34

GRAND LAKE, COLORADO

Project Number: 020379-01-001

Prepared for:
RTA Grand Lake Lodge II, LLC
2082 Michelson Drive, 4th Fl.
Irvine, CA 92612

Contact: Francis Corso
Phone: (949) 560-4789

Prepared by:

Bowman
CONSULTING

603 Park Point Drive, Suite 100
Golden, Colorado 80401

Contact: Christopher L Perdue, P.E.
Phone: 303-801-2911

November 30, 2018
REVISED: December 21, 2018
"This report and plan for the drainage design of Grand Lake Lodge was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Grand Lake, Colorado for the owners thereof. I acknowledge my full familiarity and knowledge of the Grand County Storm Drainage Design and Technical Criteria Manual, as well as the Colorado Department of Transportation and Federal Highway Administration design and construction practices. I understand that the Town of Grand Lake does not and will not assume liability for drainage facilities designed by others. I certify that that the proposed improvements described in this report will not cause damage to adjacent or downstream properties resulting from erosion, flood, or environmental impact during construction and after completion."

Christopher L Perdue, P.E.
State of Colorado No. 50745
For and on behalf of Bowman Consulting

"RTA Grand Lake Lodge II, LLC hereby certifies that the drainage facilities for Grand Lake Lodge shall be constructed according to the design presented in this report. I understand that the Town of Grand Lake does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Grand Lake reviews drainage plans pursuant to the Town of Grand Lake Municipal Code; but cannot, on behalf of RTA Grand Lake Lodge II, LLC, guarantee that final drainage design review will absolve RTA Grand Lake Lodge II, LLC and/or their successors and/or assigns of future liability for improper design."

________________________
Name of Developer

________________________
Authorized Signature

Bowman Consulting
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1 General Location and Description ................................................................. 3  
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APPENDIX B – Hydraulic Computations  
APPENDIX C – Detention Pond Computations  
APPENDIX D – Referenced Information  
APPENDIX E – Drainage Maps
1 General Location and Description

1.1 Site Location
The Grand Lake Lodge (hereafter, the Site) is a 54.4-acre development (Site) located in the Town of Grand Lake. The Site is located in Sections 5 and 6, Township 3 North, Range 75 West and Sections 31 and 32, Township 4 North, Range 75 West of the Sixth P.M. The Site is bordered by the Rocky Mountain National Park on the east, north, and west, and to the south by residential lots along Mountain Ave and W Portal Road within the Town of Grand Lake.

Figure 1-1
Vicinity Map

1.2 Description of Property
The Site is presently undeveloped, consisting mainly of mountainous terrain. The Site generally slopes at 10-25%, the majority of the site generally slopes from north to south, and a portion of the western site slopes to the west. There are no major drainage channels located within the site. Historically, drainage across the site consists of sheet flow. Additionally, an abandoned sewage treatment pond is located on the western portion of the site.
The site is made up of Hydrologic Soil Group A soils which consist of Scout Cobbly Sandy Loam and Enentah Very Stony Loam. A Soils Map is included in Appendix D. Existing ground cover consists of forested areas with mountainous terrain. The only area of classified wetlands on the site is the area of the abandoned sewage treatment pond which is defined as a Palustrine Unconsolidated Bottom Semi-Permanently Flooded (PUBF) Freshwater Pond. A wetland map is attached in Appendix D.

The Site is not located within a FEMA designated Zone X. Areas outside the 100-year floodplain, as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Grand County, Colorado and Incorporated Areas, Panel 314 Map No. 08049 C 0314 C, effective date January 2, 2008. The FIRM panel is attached in Appendix D.

At full build-out the site will contain an additional 86 rental units, a visitor's center/manager's unit. The new development proposed at this time consists of the cabins, driveways, roads, two detention ponds to treat and release the water capture volume for the site, common areas and landscaping. A small traditional storm drainage conveyance and collection system will be provided on-site to convey runoff to the proposed detention facilities. At full buildout the approximate imperviousness will be 24.8% compared to 11.9% in the existing condition.

2 Drainage Basins and Sub-Basins

2.1 Major Drainage Basins

The Site is located within the Colorado River watershed. It is also part of Three Lakes Watershed which consist of the Granby Reservoir, Shadow Mountain Reservoir and Grand Lake.

2.2 Minor Drainage Basins

The contributing drainage area of the site is approximately 40.18 acres which has been analyzed for this Drainage Report and is divided into 30 onsite Basins which are distinguished with a letter which correlating to the receiving detention facility. ‘A’ basins drain to Pond A and ‘B’ Basins drain to Pond B.

Pre-Developed (Historic) Drainage Basins

In the existing condition, there are two primary discharge points located in the westernmost portion of the Grand Lake Lodge Property which are delineated on Plan Sheet DD-8 located in Appendix E as PA and PB¹. Our analysis will focus on the ultimate release rate in comparison to the existing rate at these two points to mitigate adverse effects to downstream properties.

¹ Basin HA correlates to Design Point PA and Basin HB correlates to Design Point PB
Basin HA

Basin HA is located central to the Grand Lake Lodge property and consists of approximately 31.85 acres of on and off-site drainage. Runoff is conveyed through this basin via a combination of sheet flow, shallow concentrated flow and channel flow within roadside ditches. Basin HA includes approximately half of the existing developed area of the Grand Lake Lodge property. The impervious percentage is 13.2% yielding a 10-year and 100-year runoff coefficient of 0.07 and 0.21, respectively. Those variables equate to a 10 year and 100 year runoff rate of 2.9 cfs and 18.7 cfs.

Basin HB

Basin HB is situated in the westernmost portion of the Grand Lake Lodge property and consists of approximately 8.33 acres of on and off-site drainage. Runoff in this area primarily sheet flows into the existing lagoon and gradually infiltrates overtime. The areas within HB not tributary to the lagoon sheet flows south into a natural swale where it concentrates and leaves the Grand Lake property towards Mountain Avenue. Impervious area within this basin consists of the existing access road. The impervious percentage is approximately 6.0% equating to a 10 year and 100 year runoff coefficient of 0.03 and 0.16, respectively. The 10 year and 100 year runoff for this basin is 0.3 cfs and 4.5 cfs.

Post Developed Drainage Basins

With construction of the proposed improvements, the outfall locations for Basins HA and HB (Design Points PA and PB) will be honored with as little alteration to existing divides as feasible. In the developed condition analysis, Basins HA and HB have been divided into small basins to allow for proper analysis of the proposed runoff collection and conveyance systems. A brief summary of each basin is provided on the following pages.

Basin A1

Basin A1 is primarily made up of offsite drainage from the National Park located northeast of the site. Onsite ground cover consists of access roads, proposed cabins and open space. The contributing area of Basin A1 is 11.44 acres which is 5.8% impervious. The 10-year and 100-year runoff coefficients are 0.03 and 0.16. The 10-year and 100-year runoff is 0.5 cfs and 4.6 cfs.

Basin A2

Basin A2 drains a northern portion of the site which is currently an undeveloped forestry area which will be developed with two cabins and a portion of proposed access road. The contributing area is 0.91 acres which is 23.1% impervious. The 10-year and 100-year runoff coefficients are 0.14 and 0.29. The 10-year and 100-year runoff is 0.3 cfs and 0.9 cfs.
**Basin A3**
Basin A3 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.09 acres which is 67.3% impervious. The 10-year and 100-year runoff coefficients are 0.54 and 0.63. The 10-year and 100-year runoff is 0.1 cfs and 0.3 cfs.

**Basin A4**
Basin A4 drains a portion of the site which is currently an undeveloped forestry area which will be developed with five cabins. The contributing area is 0.56 acres which is 31.9% impervious. The 10-year and 100-year runoff coefficients are 0.21 and 0.36. The 10-year and 100-year runoff is 0.3 cfs and 0.8 cfs.

**Basin A5**
Basin A5 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.19 acres which is 79.4% impervious. The 10-year and 100-year runoff coefficients are 0.66 and 0.73. The 10-year and 100-year runoff is 0.4 cfs and 0.7 cfs.

**Basin A6**
Basin A6 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.33 acres which is 67.3% impervious. The 10-year and 100-year runoff coefficients are 0.54 and 0.63. The 10-year and 100-year runoff is 0.5 cfs and 1.0 cfs.

**Basin A7**
Basin A7 drains a portion of the site which is currently an undeveloped forestry area which will be developed with ten cabins. The contributing area is 1.39 acres which is 35.3% impervious. The 10-year and 100-year runoff coefficients are 0.24 and 0.39. The 10-year and 100-year runoff is 0.8 cfs and 2.2 cfs.

**Basin A8**
Basin A8 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.11 acres which is 73.3% impervious. The 10-year and 100-year runoff coefficients are 0.60 and 0.68. The 10-year and 100-year runoff is 0.2 cfs and 0.4 cfs.

**Basin A9**
Basin A9 drains a portion of the site which is currently an undeveloped forestry area which will be developed with two cabins. The contributing area is 0.34 acres which is 24.2% impervious. The 10-year and 100-year runoff coefficients are 0.15 and 0.30. The 10-year and 100-year runoff is 0.2 cfs and 0.5 cfs.

**Basin A10**
Basin A10 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.15 acres...
which is 67.3% impervious. The 10-year and 100-year runoff coefficients are 0.54 and 0.63. The 10-year and 100-year runoff is 0.2 cfs and 0.5 cfs.

**Basin A11**
Basin A11 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.19 acres which is 69.1% impervious. The 10-year and 100-year runoff coefficients are 0.55 and 0.65. The 10-year and 100-year runoff is 0.3 cfs and 0.6 cfs.

**Basin A12**
Basin A12 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a community center. The contributing area is 1.69 acres which is 41.4% impervious. The 10-year and 100-year runoff coefficients are 0.29 and 0.43. The 10-year and 100-year runoff is 1.1 cfs and 2.7 cfs.

**Basin A13**
Basin A13 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.08 acres which is 75.5% impervious. The 10-year and 100-year runoff coefficients are 0.62 and 0.70. The 10-year and 100-year runoff is 0.1 cfs and 0.3 cfs.

**Basin A14**
Basin A14 drains a portion of the site which is currently an undeveloped forestry area which will be developed with eleven cabins. The contributing area is 0.99 acres which is 20.9% impervious. The 10-year and 100-year runoff coefficients are 0.13 and 0.27. The 10-year and 100-year runoff is 0.3 cfs and 1.1 cfs.

**Basin A15**
Basin A15 drains a portion of the existing grand lake lodge site which is currently comprised of cabins and access road. The basin will not be further developed. The contributing area is 4.18 acres which is 20.7% impervious. The 10-year and 100-year runoff coefficients are 0.13 and 0.27. The 10-year and 100-year runoff is 1.1 cfs and 4.0 cfs.

**Basin A16**
Basin A16 drains a portion of the existing grand lake lodge site which is currently comprised of cabins, the main lodge, access road and parking area. The basin will not be further developed. The contributing area is 5.56 acres which is 38.8% impervious. The 10-year and 100-year runoff coefficients are 0.27 and 0.41. The 10-year and 100-year runoff is 3.1 cfs and 7.9 cfs.

**Basin A17**
Basin A17 drains a portion of the site which is currently an undeveloped forestry area which will be developed with eight cabins. The contributing area is 1.68 acres which is
25.7% impervious. The 10-year and 100-year runoff coefficients are 0.16 and 0.31. The 10-year and 100-year runoff is 0.7 cfs and 2.2 cfs.

**Basin A18**
Basin A18 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.11 acres which is 73.3% impervious. The 10-year and 100-year runoff coefficients are 0.60 and 0.68. The 10-year and 100-year runoff is 0.2 cfs and 0.4 cfs.

**Basin A19**
Basin A19 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.06 acres which is 67.3% impervious. The 10-year and 100-year runoff coefficients are 0.54 and 0.63. The 10-year and 100-year runoff is 0.1 cfs and 0.2 cfs.

**Basin A20**
Basin A20 drains a portion of the site which is currently an undeveloped forestry area which will be developed with six cabins. The contributing area is 1.04 acres which is 33.0% impervious. The 10-year and 100-year runoff coefficients are 0.22 and 0.37. The 10-year and 100-year runoff is 0.5 cfs and 1.5 cfs.

**Basin A21**
Basin A21 drains a portion of the site which is currently an undeveloped forestry area which will be developed into Pond A. The contributing area is 0.76 acres which is 9.7% impervious. The 10-year and 100-year runoff coefficients are 0.05 and 0.19. The 10-year and 100-year runoff is 0.1 cfs and 0.6 cfs.

**Basin B1**
Basin B1 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.24 acres which is 79.6% impervious. The 10-year and 100-year runoff coefficients are 0.66 and 0.73. The 10-year and 100-year runoff is 0.5 cfs and 0.9 cfs.

**Basin B2**
Basin B2 drains a portion of the site which is currently an undeveloped forestry area which will be developed with eight cabins. The contributing area is 2.18 acres which is 20.6% impervious. The 10-year and 100-year runoff coefficients are 0.12 and 0.27. The 10-year and 100-year runoff is 0.4 cfs and 1.5 cfs.

**Basin B3**
Basin B3 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road with an open space area. The contributing area is 0.16 acres which is 44.9% impervious. The 10-year and 100-year runoff coefficients are 0.33 and 0.46. The 10-year and 100-year runoff is 0.2 cfs and 0.4 cfs.
**Basin B4**
Basin B4 drains a portion of the site which is currently an undeveloped forestry area which will be developed with five cabins. The contributing area is 1.19 acres which is 29.2% impervious. The 10-year and 100-year runoff coefficients are 0.19 and 0.34. The 10-year and 100-year runoff is 0.6 cfs and 1.8 cfs.

**Basin B5**
Basin B5 drains a portion of the site which is currently an undeveloped forestry area which will be developed with six cabins. The contributing area is 1.21 acres which is 23.8% impervious. The 10-year and 100-year runoff coefficients are 0.15 and 0.30. The 10-year and 100-year runoff is 0.4 cfs and 1.4 cfs.

**Basin B6**
Basin B6 drains a portion of the site which is currently an undeveloped forestry area which will be developed with six cabins. The contributing area is 0.94 acres which is 36.3% impervious. The 10-year and 100-year runoff coefficients are 0.25 and 0.39. The 10-year and 100-year runoff is 0.6 cfs and 1.5 cfs.

**Basin B7**
Basin B7 drains a portion of the site which is currently an undeveloped forestry area which will be developed into a proposed access road. The contributing area is 0.07 acres which is 100% impervious. The 10-year and 100-year runoff coefficients are 0.87 and 0.90. The 10-year and 100-year runoff is 0.2 cfs and 0.3 cfs.

**Basin B8**
Basin B8 drains a portion of the site which is currently an undeveloped forestry area which will be developed with eleven cabins and Pond B. The contributing area is 1.63 acres which is 43.1% impervious. The 10-year and 100-year runoff coefficients are 0.31 and 0.45. The 10-year and 100-year runoff is 1.5 cfs and 3.6 cfs.

**Basin B9**
Basin B9 drains a portion of the site which is currently an undeveloped forestry area which will be developed with two cabins. The contributing area is 0.71 acres which is 7.1% impervious. The 10-year and 100-year runoff coefficients are 0.03 and 0.17. The 10-year and 100-year runoff is 0.1 cfs and 0.4 cfs.

3 **Drainage Design Criteria**

3.1 **Regulations**
This drainage report was prepared in accordance with the Grand County Storm Drainage Design and Technical Criteria Manual.
3.2 Hydrology

The minor storm was calculated for the 10-year recurrence interval and the major storm was calculated at the 100-year recurrence interval. The Rational Method was used for determining peak runoff discharges for the development. Runoff coefficients were calculated for each on-site basin using values from UDFCD’s tables 6-3 and 6-4 which are included in Appendix A.

Section 5.2 of the Grand County Storm Drainage Design and Technical Criteria Manual states that standard forms and spreadsheets should be used from Urban Drainage and Flood Control District. The project’s design rainfall intensities were determined using the one-hour, 10-year precipitation depth of 0.99 inches and a one-hour, 100-year precipitation depth of 1.47. These precipitation depths are found in Table 401 of the Grand County Storm Drainage Design and Technical Criteria Manual. The developed time of concentrations for each basin at the design points were calculated using the information included in Appendix A, in accordance with the procedures outlined in UDFCD Volume 1. The initial overland flow time was calculated using UDFCD’s Equation 6-3. Travel times were calculated using Equation 6-4 of the UDFCD Drainage Criteria Manuals and the conveyance coefficients listed in the calculations of Appendix A.

3.3 Hydraulics

All storm sewers are sized to convey the 100-year storm event. Inlets have been sized to capture runoff using the CDOT Type C rating curve. StormCAD, a software program developed by Bentley Systems, was used to determine hydraulic gradelines (HGLs) and storm sewer velocities. Output tables from StormCAD for the 10-year and 100-year storm are included in Appendix B.

4 Stormwater Management Facility Design

4.1 Stormwater Conveyance Facilities

At the time of vertical development, stormwater will be conveyed through the site by sheet flow with a series of storm inlet connections and two detention ponds. The facilities have been designed with sufficient capacity to pass the 100-year storm event. The storm sewers will be sized to meet the Grand County Storm Drainage Design and Technical Criteria Manual.

4.2 Stormwater Storage Facilities

Two Extended Detention Basins (EDB) ponds are to be constructed within the site that will detain and will safely pass the 100-year storm event. Based on the release of the ponds there will be no adverse impacts to downstream properties. Maintenance access to each of the proposed ponds has been provided and can be seen on the drainage maps in Appendix E. Both ponds have been designed using the modified FAA procedure as allowed by Section 10.2.2 of the Grand County Storm Drainage Design and Technical Criteria Manual.
Pond A
Pond A is located along the southeastern portion of the site. The water capture volume is provided for drainage basins A1 thru A21 for a runoff area of 31.85. The required volume of Pond A is 1.144 acre-feet. Maximum allowable release from the developed basin shall not be greater than the historic basin discharge for both the minor and major recurrence interval (2.9 cfs, 18.7 cfs).

Pond A and its outlet structure have been sized to capture runoff from the WQCV, 10-year and 100-year storm events. The WQCV will be released over a time period of 40 hours. The outlet structure was designed by utilizing the Urban Drainage UD-Detention, modified FAA spreadsheet. The WQCV will be released through 3 @ 1-11/16” orifice holes spaced 11.6 inches apart. The 10-year and 100-year storms will be released through same orifices as well as through the top of the outlet structure. The 100-year release rate is controlled by a restrictor plate which will be installed over the 24” outfall pipe. Release rates for the 10-year and 100-year storm events are 2.9 cfs and 18.7 cfs respectively.

The emergency overflow spillway was designed to be 70 feet in length at an elevation corresponding to the 100-year water surface elevation in the pond, 8597.40. When the incoming flow rate of 19.9 cfs passes over the spillway, the resultant flow depth is 0.23 feet. The berm was then set at an elevation 1 foot higher than the flow depth of the emergency spillway. See Appendix C for computations.

Pond B
Pond B is located along the southwestern portion of the site. The water capture volume is provided for drainage basins B1 thru B9 for a runoff area of 8.33. The required volume of Pond B is 0.446 acre-feet. Maximum allowable release from the developed basin shall not be greater than the historic basin discharge for both the minor and major recurrence interval (0.32 cfs, 4.52 cfs).

Pond B and its outlet structure have been sized to capture runoff from the WQCV, 10-year and 100-year storm events. The WQCV will be released over a time period of 40 hours. The outlet structure was designed by utilizing the Urban Drainage UD-Detention, modified FAA spreadsheet. The WQCV will be released through 3 @ 7/8” orifice holes spaced 8 inches apart. The 10-year and 100-year storms will be released through same orifices as well as through the top of the outlet structure. The 100-year release rate is controlled by a restrictor plate which will be installed over the 18” outfall pipe. Release rates for the 10-year and 100-year storm events are 0.32 cfs and 4.52 cfs respectively.

The emergency overflow structure is a standard Type-C inlet with a grate elevation corresponding to the 100-year water surface elevation in the pond, 8598.40. When the incoming flow rate of 6.1 cfs passes through the overflow structure, the resultant headwater depth is 0.32 feet. The berm was then set at an elevation 1 foot higher than the flow depth of the emergency spillway. See Appendix C for computations.
### Table 4-1
Stormwater Storage Facilities Summary

<table>
<thead>
<tr>
<th>ID</th>
<th>Watershed Area (acres)</th>
<th>Total Imp. (%)</th>
<th>100-Year Inflow (cfs)</th>
<th>100-Year Outflow (cfs)</th>
<th>WQCV (ac-ft)</th>
<th>10-year + WQCV (ac-ft)</th>
<th>100-year + 10-year + WQCV (ac-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond A</td>
<td>31.85</td>
<td>23.0%</td>
<td>19.92</td>
<td>18.68</td>
<td>0.406</td>
<td>0.805</td>
<td>1.144</td>
</tr>
<tr>
<td>Pond B</td>
<td>8.33</td>
<td>30.2%</td>
<td>6.13</td>
<td>4.52</td>
<td>0.127</td>
<td>0.327</td>
<td>0.446</td>
</tr>
</tbody>
</table>

#### 4.3 Erosion Control
Erosion and Sediment Control will be provided in accordance with CDPHE stormwater management plan preparation guidance and the UDFCD Criteria Manual. During construction nearly all of the site’s stormwater will be captured by the diversion dikes along the perimeter of the Site. The diversion dikes drain to two Sediment Basins which will ultimately be converted to Pond A and Pond B. The final condition outlet structures for the detention ponds will be constructed in the initial phase and converted for use in the sediment basin. Additional sediment control will be provided with silt fence on the downstream side of the Site. All areas not stabilized by pavement, landscaping, or other hard surfaces will seeded and mulched for permanent stabilization.

Seeding, riprap and the mulching placed within 100’ of the National Parks boundary should be certified weed-free to prevent the spread of invasive exotic plants into the park.

#### 4.4 Floodplain Modification
There will be no modification to FEMA designated floodplains as the site is not located within a FEMA designated Zone X, Areas outside the 100-year floodplain, as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Grand County, Colorado and Incorporated Areas, Panel 314 Map No. 08049 C 0314 C, effective date January 2, 2008. The FIRM panel is attached in Appendix D.

#### 4.5 Additional Permitting Requirements
A Stormwater Discharge permit may be required from the Colorado Department of Public Health & Environment, an Army Corps of Engineers permit may be required, and a CDOT Permit may also be needed.

#### 5 Conclusions

#### 5.1 Compliance with Standards
The Site is designed in compliance with the Grand County Storm Drainage Design and Technical Criteria Manual.
5.2 Adaptations from Criteria

No variances will be required for the development of the Grand Lake Lodge.

6 References


Appendices

APPENDIX A – Hydrologic Computations
APPENDIX B – Hydraulic Computations
APPENDIX C – Detention Pond Computations
APPENDIX D – Referenced Information
APPENDIX E – Drainage Maps
## APPENDIX A

### HYDROLOGIC COMPUTATIONS

**Table 6-3. Recommended percentage imperviousness values**

<table>
<thead>
<tr>
<th>Land Use or Surface Characteristics</th>
<th>Percentage Imperviousness (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business:</strong></td>
<td></td>
</tr>
<tr>
<td>Downtown Areas</td>
<td>95</td>
</tr>
<tr>
<td>Suburban Areas</td>
<td>75</td>
</tr>
<tr>
<td><strong>Residential lots (lot area only):</strong></td>
<td></td>
</tr>
<tr>
<td>Single-family</td>
<td></td>
</tr>
<tr>
<td>2.5 acres or larger</td>
<td>12</td>
</tr>
<tr>
<td>0.75 – 2.5 acres</td>
<td>20</td>
</tr>
<tr>
<td>0.25 – 0.75 acres</td>
<td>30</td>
</tr>
<tr>
<td>0.25 acres or less</td>
<td>45</td>
</tr>
<tr>
<td>Apartments</td>
<td>75</td>
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<tr>
<td><strong>Industrial:</strong></td>
<td></td>
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<tr>
<td>Light areas</td>
<td>80</td>
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<tr>
<td>Heavy areas</td>
<td>90</td>
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<td><strong>Parks, cemeteries</strong></td>
<td>10</td>
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<tr>
<td><strong>Playgrounds</strong></td>
<td>25</td>
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<tr>
<td><strong>Schools</strong></td>
<td>55</td>
</tr>
<tr>
<td><strong>Railroad yard areas</strong></td>
<td>50</td>
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<td><strong>Undeveloped Areas:</strong></td>
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<td>Historic flow analysis</td>
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<td>Greenbelts, agricultural</td>
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<tr>
<td>Off-site flow analysis (when land use not defined)</td>
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<td><strong>Streets:</strong></td>
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<tr>
<td>Paved</td>
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<tr>
<td>Gravel (packed)</td>
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<tr>
<td>Drive and walks</td>
<td>90</td>
</tr>
<tr>
<td>Roofs</td>
<td>90</td>
</tr>
<tr>
<td>Lawns, sandy soil</td>
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<tr>
<td>Lawns, clayey soil</td>
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</tr>
</tbody>
</table>
Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

<table>
<thead>
<tr>
<th>NRCS Soil Group</th>
<th>Storm Return Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-Year</td>
</tr>
<tr>
<td>A</td>
<td>$C_A = 0.84t^{1.382}$</td>
</tr>
<tr>
<td>B</td>
<td>$C_B = 0.84t^{1.416}$</td>
</tr>
<tr>
<td>C/D</td>
<td>$C_{CD} = 0.83t^{1.322}$</td>
</tr>
</tbody>
</table>

Where:

$t = \%$ imperviousness (expressed as a decimal)

$C_A =$ Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

$C_B =$ Runoff coefficient for NRCS HSG B soils

$C_{CD} =$ Runoff coefficient for NRCS HSG C and D soils.

$$t_r = \frac{t_r}{60K \sqrt{S_n}} = \frac{L_r}{60V_r}$$  
Equation 6-4

Where:

$t_r =$ channelized flow time (travel time, min)

$L_r =$ waterway length (ft)

$S_n =$ waterway slope (ft/ft)

$V_r =$ travel time velocity (ft/sec) = $K$,$S_n$

$K =$ NRCS conveyance factor (see Table 6-2).

Table 6-2. NRCS Conveyance factors, K

<table>
<thead>
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<th>Type of Land Surface</th>
<th>Conveyance Factor, K</th>
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<tr>
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<tr>
<td>Tillagefield</td>
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</tr>
<tr>
<td>Short pasture and lawns</td>
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</tr>
<tr>
<td>Nearly bare ground</td>
<td>10</td>
</tr>
<tr>
<td>Grassed waterway</td>
<td>15</td>
</tr>
<tr>
<td>Paved areas and shallow paved swales</td>
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</table>
To develop depth-duration curves or intensity-duration curves for the Rational Method of runoff analysis take the 1-hour depth(s) obtained from NOAA Atlas 14 and apply Equation 5-1 for the duration (or durations) of interest:

\[
I = \frac{28.5\, P_t}{(10 + T_d)^{0.18}}
\]

Where:

- \( I \) = rainfall intensity (inches per hour)
- \( P_t \) = 1-hour point rainfall depth (inches)
- \( T_d \) = storm duration (minutes)

The initial or overland flow time, \( t_o \), may be calculated using Equation 6-3:

\[
t_o = \frac{0.395(1.1 - C_s)\sqrt{L_o}}{S_o^{0.33}}
\]

Where:

- \( t_o \) = overland (initial) flow time (minutes)
- \( C_s \) = runoff coefficient for 5-year frequency (from Table 6-4)
- \( L_o \) = length of overland flow (ft)
- \( S_o \) = average slope along the overland flow path (ft/ft).
## TIME OF CONCENTRATION

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<th>Designer: Craig Rothleibler</th>
<th>Bowman Consulting Group</th>
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### Sub-Basin Data

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<th>Channelized Flow Time</th>
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### Overland (Initial) Flow Time

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<tr>
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<th>Overland Flow Length (mi)</th>
<th>Overland Flow Slope (s)</th>
<th>Overland Flow Time (hr)</th>
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<tr>
<td>A4</td>
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</tr>
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### Channelized (Travel) Flow Time

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<th>Channelized Flow Velocity (mph)</th>
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<th>Regional Tc (hr)</th>
<th>Selected Tc (hr)</th>
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### Time of Concentration

- $R_{\text{Channelized}} = \text{NNRCS} \times \text{Factor K}$
- $t_{\text{Channelized}} = \frac{\text{Flow Time}}{t_{\text{Flow Rate}}}$
- $t_{\text{Regional}} = (26 - 170) + \frac{46(140 + Q)}{O_{\text{Bank}}} + \frac{46(140 + 0.3)}{Q_{\text{Bank}}}$
- $t_{\text{Selected}} = \max\{t_{\text{Channelized}}, t_{\text{Regional}}, t_{\text{Computed}}\}$

**Cells in this color are for required user input**
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<th>Remarks</th>
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| B2 B2                         | 2.58           | 0.13         | 24.3 | 0.37 | 1.56 | 0.4 | 0.4 | |</p>
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Note: The values in the table represent some form of data or measurements, but without further context, it's difficult to interpret their exact meaning.
## Storm Drainage System Design - 100-Year Design Storm

### Table

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## Rainfall Data
020379 - Grand Lake Lodge
Grand Lake, CO

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APPENDIX B
HYDRAULIC COMPUTATIONS
Profile Report
Engineering Profile - STM TYPE-C INLET A5 to O-1 (020379 - Storm CAD.stsw)
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<th>Length (Start Defined) (ft)</th>
<th>Slope (Calculated) (ft/ft)</th>
<th>Diameter (in)</th>
<th>Manning's n</th>
<th>Flow (cfs)</th>
<th>Velocity (ft/s)</th>
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Storm Collection System.xls
### 100-yr Scenario - Storm Collection System

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![CULVERT A1 Diagram](image_url)
CULVERT A3

Invert Elev Dn (ft) = 8647.50
Pipe Length (ft) = 65.00
Slope (%) = 1.00
Invert Elev Up (ft) = 8648.15
Rise (in) = 18.0
Shape = Circular
Span (in) = 18.0
No. Barrels = 1
n-Value = 0.013
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Calculations
Qmin (cfs) = 1.40
Qmax (cfs) = 1.40
Tailwater Elev (ft) = (dc+D)/2

Highlighted
Qtotal (cfs) = 1.40
Qpipe (cfs) = 1.40
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 1.16
Veloc Up (ft/s) = 3.21
HGL Dn (ft) = 8648.47
HGL Up (ft) = 8648.59
Hw Elev (ft) = 8648.75
Hw/D (ft) = 0.40
Flow Regime = Inlet Control

Embankment
Top Elevation (ft) = 8652.47
Top Width (ft) = 24.00
Crest Width (ft) = 50.00

Diagram of CULVERT A3 showing elevations and depth with labels for different sections.
CULVERT A6

Invert Elev Dn (ft) = 8636.00
Pipe Length (ft) = 75.50
Slope (%) = 0.93
Invert Elev Up (ft) = 8636.70
Rise (in) = 18.0
Shape = Circular
Span (in) = 18.0
No. Barrels = 1
n-Value = 0.013
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Embankment
Top Elevation (ft) = 8639.27
Top Width (ft) = 24.00
Crest Width (ft) = 50.00

Calculations
Qmin (cfs) = 0.90
Qmax (cfs) = 0.90
Tailwater Elev (ft) = (dc+D)/2

Highlighted
Qtotal (cfs) = 0.90
Qpipe (cfs) = 0.90
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 0.79
Veloc Up (ft/s) = 2.84
HGL Dn (ft) = 8636.93
HGL Up (ft) = 8637.05
Hw Elev (ft) = 8637.17
Hw/D (ft) = 0.32
Flow Regime = Inlet Control
### CULVERT A10

<table>
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<tbody>
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<tr>
<td>Pipe Length (ft)</td>
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</tr>
<tr>
<td>Slope (%)</td>
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</tr>
<tr>
<td>Invert Elev Up (ft)</td>
<td>8638.17</td>
</tr>
<tr>
<td>Rise (in)</td>
<td>24.0</td>
</tr>
<tr>
<td>Shape</td>
<td>Circular</td>
</tr>
<tr>
<td>Span (in)</td>
<td>24.0</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>1</td>
</tr>
<tr>
<td>n-Value</td>
<td>0.013</td>
</tr>
<tr>
<td>Culvert Type</td>
<td>Circular Concrete</td>
</tr>
<tr>
<td>Culvert Entrance</td>
<td>Groove end projecting (C)</td>
</tr>
<tr>
<td>Coeff. K,M,c,Y,k</td>
<td>0.0045, 2, 0.0317, 0.69, 0.2</td>
</tr>
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</table>

**Calculations**

<table>
<thead>
<tr>
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<th>Value</th>
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<tr>
<td>Qmin (cfs)</td>
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<tr>
<td>Qmax (cfs)</td>
<td>11.80</td>
</tr>
<tr>
<td>Tailwater Elev (ft)</td>
<td>(dc+D)/2</td>
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**Highlighted**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
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<td>11.80</td>
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<tr>
<td>Qpipe (cfs)</td>
<td>11.80</td>
</tr>
<tr>
<td>Qovertop (cfs)</td>
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<tr>
<td>Veloc Dn (ft/s)</td>
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<tr>
<td>Veloc Up (ft/s)</td>
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<td>HGL Dn (ft)</td>
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<td>HGL Up (ft)</td>
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<td>Hw Elev (ft)</td>
<td>8639.98</td>
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<tr>
<td>Hw/D (ft)</td>
<td>0.91</td>
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<tr>
<td>Flow Regime</td>
<td>Inlet Control</td>
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**Embankment**

<table>
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<tr>
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<tbody>
<tr>
<td>Top Elevation (ft)</td>
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<tr>
<td>Top Width (ft)</td>
<td>24.00</td>
</tr>
<tr>
<td>Crest Width (ft)</td>
<td>50.00</td>
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## CULVERT A11-2

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<tr>
<td>Invert Elev Dn (ft)</td>
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<tr>
<td>Pipe Length (ft)</td>
<td>73.40</td>
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<tr>
<td>Slope (%)</td>
<td>5.41</td>
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<tr>
<td>Invert Elev Up (ft)</td>
<td>8616.74</td>
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<tr>
<td>Rise (in)</td>
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<tr>
<td>Shape</td>
<td>Circular</td>
</tr>
<tr>
<td>Span (in)</td>
<td>18.0</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>1</td>
</tr>
<tr>
<td>n-Value</td>
<td>0.013</td>
</tr>
<tr>
<td>Culvert Type</td>
<td>Circular Concrete</td>
</tr>
<tr>
<td>Culvert Entrance</td>
<td>Groove end projecting (C)</td>
</tr>
<tr>
<td>Coeff. K,M,c,Y,k</td>
<td>0.0045, 2, 0.0317, 0.69, 0.2</td>
</tr>
</tbody>
</table>

### Embankment
- Top Elevation (ft) = 8619.88
- Top Width (ft) = 24.00
- Crest Width (ft) = 50.00

### Calculations
- $Q_{min}$ (cfs) = 10.80
- $Q_{max}$ (cfs) = 10.80
- Tailwater Elev (ft) = $(dc+D)/2$

### Highlighted
- $Q_{total}$ (cfs) = 10.80
- $Q_{pipe}$ (cfs) = 10.80
- $Q_{overtop}$ (cfs) = 0.00
- Veloc Dn (ft/s) = 6.35
- Veloc Up (ft/s) = 6.82
- HGL Dn (ft) = 8614.15
- HGL Up (ft) = 8618.00
- Hw Elev (ft) = 8618.92
- Hw/D (ft) = 1.45
- Flow Regime = Inlet Control
CULVERT B1

Invert Elev Dn (ft) = 8620.66
Pipe Length (ft) = 67.10
Slope (%) = 2.98
Invert Elev Up (ft) = 8622.66
Rise (in) = 18.0
Shape = Circular
Span (in) = 18.0
No. Barrels = 1
n-Value = 0.013
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Calculations

Qmin (cfs) = 1.80
Qmax (cfs) = 1.80
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 1.80
Qpipe (cfs) = 1.80
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 1.44
Veloc Up (ft/s) = 3.45
HGL Dn (ft) = 8621.66
HGL Up (ft) = 8623.17
Hw Elev (ft) = 8623.33
Hw/D (ft) = 0.45
Flow Regime = Inlet Control

Embarkment

Top Elevation (ft) = 8626.06
Top Width (ft) = 24.00
Crest Width (ft) = 50.00
### Culvert B2

<table>
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<th>Parameter</th>
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<tr>
<td>Invert Elev Dn (ft)</td>
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<td>Pipe Length (ft)</td>
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<tr>
<td>Slope (%)</td>
<td>6.06</td>
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<tr>
<td>Invert Elev Up (ft)</td>
<td>8618.99</td>
</tr>
<tr>
<td>Rise (in)</td>
<td>18.0</td>
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<td>Shape</td>
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</tr>
<tr>
<td>Span (in)</td>
<td>18.0</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>1</td>
</tr>
<tr>
<td>n-Value</td>
<td>0.013</td>
</tr>
<tr>
<td>Culvert Type</td>
<td>Circular Concrete</td>
</tr>
<tr>
<td>Culvert Entrance</td>
<td>Groove end projecting (C)</td>
</tr>
<tr>
<td>Coeff. K,M,c,Y,k</td>
<td>0.0045, 2, 0.0317, 0.69, 0.2</td>
</tr>
</tbody>
</table>

### Calculations

- $Q_{\text{min}}$ (cfs) = 1.80
- $Q_{\text{max}}$ (cfs) = 1.80
- Tailwater Elev (ft) = $(dc+D)/2$

### Highlighted

- $Q_{\text{total}}$ (cfs) = 1.80
- $Q_{\text{pipe}}$ (cfs) = 1.80
- $Q_{\text{overtop}}$ (cfs) = 0.00
- $\text{Veloc Dn (ft/s)}$ = 1.44
- $\text{Veloc Up (ft/s)}$ = 3.45
- $HGL$ Dn (ft) = 8616.25
- $HGL$ Up (ft) = 8619.50
- $Hw$ Elev (ft) = 8619.64
- $Hw/D$ (ft) = 0.43
- Flow Regime = Inlet Control

---

![Culvert B2 Diagram](E100)
### Culvert Report

**CULVERT B9**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Invert Elev Dn (ft)</td>
<td>8601.00</td>
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<tr>
<td>Pipe Length (ft)</td>
<td>163.20</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>1.23</td>
</tr>
<tr>
<td>Invert Elev Up (ft)</td>
<td>8603.00</td>
</tr>
<tr>
<td>Rise (in)</td>
<td>18.0</td>
</tr>
<tr>
<td>Shape</td>
<td>Circular</td>
</tr>
<tr>
<td>Span (in)</td>
<td>18.0</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>1</td>
</tr>
<tr>
<td>n-Value</td>
<td>0.013</td>
</tr>
<tr>
<td>Culvert Type</td>
<td>Circular Concrete</td>
</tr>
<tr>
<td>Culvert Entrance</td>
<td>Groove end projecting (C)</td>
</tr>
<tr>
<td>Coeff. K,M,c,Y,k</td>
<td>0.0045, 2, 0.0317, 0.69, 0.2</td>
</tr>
</tbody>
</table>

**Calculations**

- Qmin (cfs) = 0.40
- Qmax (cfs) = 0.40
- Tailwater Elev (ft) = (dc+D)/2

**Highlighted**

- Qtotal (cfs) = 0.40
- Qpipe (cfs) = 0.40
- Qovertop (cfs) = 0.00
- Veloc Dn (ft/s) = 0.38
- Veloc Up (ft/s) = 2.28
- HGL Dn (ft) = 8601.87
- HGL Up (ft) = 8603.23
- Hw Elev (ft) = 8603.31
- Hw/D (ft) = 0.20
- Flow Regime = Inlet Control

---

![Culvert B9 Diagram](image-url)

---

E102
Channel Report

Hydraulx Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Friday, Jul 13 2018

Valley Pan

Triangular
Side Slopes (z:1) = 12.00, 12.00
Total Depth (ft) = 0.17
Invert Elev (ft) = 100.00
Slope (%) = 7.00
N-Value = 0.024

Calculations
Compute by: Known Q
Known Q (cfs) = 1.00

Highlighted
Depth (ft) = 0.17
Q (cfs) = 1.000
Area (sqft) = 0.35
Velocity (ft/s) = 2.88
Wetted Perim (ft) = 4.09
Crit Depth, Yc (ft) = 0.17
Top Width (ft) = 4.08
EGL (ft) = 0.30

Elev (ft)

Section

Depth (ft)

101.00
100.75
100.50
100.25
100.00
99.75

0.00
0.25
0.50
0.75
1.00

0.00
1.5
2
2.5
3
3.5
4
4.5
5
5.5

Reach (ft)
# Worksheet for Pond A Outfall

## Project Description

<table>
<thead>
<tr>
<th>Method</th>
<th>Manning Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solve For</td>
<td>Normal Depth</td>
</tr>
</tbody>
</table>

## Input Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roughness Coefficient</td>
<td>0.013</td>
</tr>
<tr>
<td>Channel Slope</td>
<td>0.05910 ft/ft</td>
</tr>
<tr>
<td>Diameter</td>
<td>2.00 ft</td>
</tr>
<tr>
<td>Discharge</td>
<td>18.68 ft³/s</td>
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</tbody>
</table>

## Results

<table>
<thead>
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<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Normal Depth</td>
<td>0.80 ft</td>
</tr>
<tr>
<td>Flow Area</td>
<td>1.18 ft²</td>
</tr>
<tr>
<td>Wetted Perimeter</td>
<td>2.75 ft</td>
</tr>
<tr>
<td>Hydraulic Radius</td>
<td>0.43 ft</td>
</tr>
<tr>
<td>Top Width</td>
<td>1.96 ft</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>1.56 ft</td>
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<tr>
<td>Percent Full</td>
<td>40.2 %</td>
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<tr>
<td>Critical Slope</td>
<td>0.00756 ft/ft</td>
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<tr>
<td>Velocity</td>
<td>15.83 ft³/s</td>
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<tr>
<td>Velocity Head</td>
<td>3.89 ft</td>
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<td>Specific Energy</td>
<td>4.70 ft</td>
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<tr>
<td>Froude Number</td>
<td>3.60</td>
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<td>Maximum Discharge</td>
<td>59.16 ft³/s</td>
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<td>Discharge Full</td>
<td>54.99 ft³/s</td>
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<td>0.00682 ft/ft</td>
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## GVF Input Data

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<tr>
<td>Length</td>
<td>0.00 ft</td>
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<tr>
<td>Number Of Steps</td>
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## GVF Output Data

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<tr>
<td>Upstream Depth</td>
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<tr>
<td>Profile Description</td>
<td></td>
</tr>
<tr>
<td>Profile Headloss</td>
<td>0.00 ft</td>
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<tr>
<td>Average End Depth Over Rise</td>
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<tr>
<td>Normal Depth Over Rise</td>
<td>40.17 %</td>
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<td>Downstream Velocity</td>
<td>Infinity ft/s</td>
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</tbody>
</table>
# Worksheet for Pond A Outfall

<table>
<thead>
<tr>
<th>GVF Output Data</th>
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</thead>
<tbody>
<tr>
<td>Upstream Velocity</td>
<td>Infinity</td>
<td>ft/s</td>
</tr>
<tr>
<td>Normal Depth</td>
<td>0.80</td>
<td>ft</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>1.56</td>
<td>ft</td>
</tr>
<tr>
<td>Channel Slope</td>
<td>0.05910</td>
<td>ft/ft</td>
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<tr>
<td>Critical Slope</td>
<td>0.00756</td>
<td>ft/ft</td>
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</table>
# Worksheet for Pond B Primary Outfall

## Project Description

- Friction Method: Manning Formula
- Solve For: Normal Depth

## Input Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Roughness Coefficient</td>
<td>0.013</td>
</tr>
<tr>
<td>Channel Slope</td>
<td>0.00500 ft/ft</td>
</tr>
<tr>
<td>Diameter</td>
<td>1.50 ft</td>
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<tr>
<td>Discharge</td>
<td>4.52 ft/s</td>
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</tbody>
</table>

## Results

<table>
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<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Depth</td>
<td>0.84 ft</td>
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<tr>
<td>Flow Area</td>
<td>1.03 ft²</td>
</tr>
<tr>
<td>Wetted Perimeter</td>
<td>2.55 ft</td>
</tr>
<tr>
<td>Hydraulic Radius</td>
<td>0.40 ft</td>
</tr>
<tr>
<td>Top Width</td>
<td>1.49 ft</td>
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<tr>
<td>Critical Depth</td>
<td>0.82 ft</td>
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<tr>
<td>Percent Full</td>
<td>56.3%</td>
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<tr>
<td>Critical Slope</td>
<td>0.00559 ft/ft</td>
</tr>
<tr>
<td>Velocity</td>
<td>4.41 ft/s</td>
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<tr>
<td>Velocity Head</td>
<td>0.30 ft</td>
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<tr>
<td>Specific Energy</td>
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<td>Froude Number</td>
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<td>Maximum Discharge</td>
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<td>Discharge Full</td>
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<td>Flow Type</td>
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## GVF Input Data

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<td>Length</td>
<td>0.00 ft</td>
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<td>Number Of Steps</td>
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## GVF Output Data

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<td>Profile Description</td>
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<tr>
<td>Profile Headloss</td>
<td>0.00 ft</td>
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<tr>
<td>Average End Depth Over Rise</td>
<td>0.00 %</td>
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<td>Normal Depth Over Rise</td>
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<td>Downstream Velocity</td>
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# Worksheet for Pond B Primary Outfall

GVF Output Data

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<tbody>
<tr>
<td>Upstream Velocity</td>
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<td>ft/s</td>
</tr>
<tr>
<td>Normal Depth</td>
<td>0.84 ft</td>
<td></td>
</tr>
<tr>
<td>Critical Depth</td>
<td>0.82 ft</td>
<td></td>
</tr>
<tr>
<td>Channel Slope</td>
<td>0.00500 ft/ft</td>
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<tr>
<td>Critical Slope</td>
<td>0.00559 ft/ft</td>
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</tbody>
</table>
# Worksheet for Pond B Emergency Outfall

## Project Description
- Friction Method: Manning Formula
- Solve For: Normal Depth

## Input Data
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roughness Coefficient</td>
<td>0.013</td>
</tr>
<tr>
<td>Channel Slope</td>
<td>0.00500 ft/ft</td>
</tr>
<tr>
<td>Diameter</td>
<td>1.50 ft</td>
</tr>
<tr>
<td>Discharge</td>
<td>6.13 ft/s</td>
</tr>
</tbody>
</table>

## Results
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Depth</td>
<td>1.04 ft</td>
</tr>
<tr>
<td>Flow Area</td>
<td>1.31 ft²</td>
</tr>
<tr>
<td>Wetted Perimeter</td>
<td>2.95 ft</td>
</tr>
<tr>
<td>Hydraulic Radius</td>
<td>0.44 ft</td>
</tr>
<tr>
<td>Top Width</td>
<td>1.38 ft</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>0.96 ft</td>
</tr>
<tr>
<td>Percent Full</td>
<td>69.2 %</td>
</tr>
<tr>
<td>Critical Slope</td>
<td>0.00629 ft/ft</td>
</tr>
<tr>
<td>Velocity</td>
<td>4.70 ft/s</td>
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<tr>
<td>Velocity Head</td>
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</tr>
<tr>
<td>Specific Energy</td>
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<tr>
<td>Froude Number</td>
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<tr>
<td>Maximum Discharge</td>
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</tr>
<tr>
<td>Discharge Full</td>
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<tr>
<td>Slope Full</td>
<td>0.00341 ft/ft</td>
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<tr>
<td>Flow Type</td>
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## GVF Input Data
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<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downstream Depth</td>
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</tr>
<tr>
<td>Length</td>
<td>0.00 ft</td>
</tr>
<tr>
<td>Number Of Steps</td>
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</table>

## GVF Output Data
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Depth</td>
<td>0.00 ft</td>
</tr>
<tr>
<td>Profile Description</td>
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</tr>
<tr>
<td>Profile Headloss</td>
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</tr>
<tr>
<td>Average End Depth Over Rise</td>
<td>0.00 %</td>
</tr>
<tr>
<td>Normal Depth Over Rise</td>
<td>69.24 %</td>
</tr>
<tr>
<td>Downstream Velocity</td>
<td>Infinity ft/s</td>
</tr>
</tbody>
</table>
### Worksheet for Pond B Emergency Outfall

**GVF Output Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Velocity</td>
<td>Infinity ft/s</td>
</tr>
<tr>
<td>Normal Depth</td>
<td>1.04 ft</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>0.96 ft</td>
</tr>
<tr>
<td>Channel Slope</td>
<td>0.00500 ft/ft</td>
</tr>
<tr>
<td>Critical Slope</td>
<td>0.00629 ft/ft</td>
</tr>
</tbody>
</table>
Culvert A1 Outlet Rip Rap Sizing Calculation
(Calendar per UDCF Drainage Criteria Manual Volume 2)

\[ L_p = 0.957 \times \frac{W}{V} \times \frac{A_r}{Q} \times \frac{D_3}{D_3 \text{ sizing per UDCF figure 9.38}} \]

where:
- \( L_p \): Length of protection (ft)
- \( W \): Width of the conduit (ft, use diameter for circular conduits)
- \( V \): Tailwater depth (ft)
- \( A_r \): Area of flow at allowable velocity (ft²)
- \( Q \): Design discharge (cfs)
- \( V' \): Allowable non-eroding velocity in the downstream channel (ft/sec)
- \( D_3 \): Diameter of the conduit for circular conduits

\[ \theta = \tan^{-1} \left( \frac{D_3}{2H} \right) \]

where:
- \( \theta \): Angle of lateral expansion of the jet
- \( D \): Diameter of the conduit
- \( H \): Head of water

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 5' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. Those criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall, use Figure 9-40 or 9-41.

3.2.1.1 Rack Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

3.2.1.2 Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

3.2.1.3 Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( \theta/(2\tan\theta) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \left( \frac{1}{2\tan\theta} \right) \left( \frac{A_r}{Q} \times \frac{D_3}{W} \right) \]

Equation 9-11

Where:
- \( L_p \): Length of protection (ft)
- \( W \): Width of the conduit (ft, use diameter for circular conduits)
- \( V \): Tailwater depth (ft)
- \( \theta \): Angle of lateral expansion of the culvert flow

and:

\[ A_r = \frac{Q}{V'} \]

Equation 9-12

Where:
- \( Q \): Design discharge (cfs)
- \( V' \): Allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_r \): Area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q/(V'H)^{1/2} \) or \( Q/(V'H)^{1/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \% \( V_p \), or \% \( H \) for circular or rectangular box culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert A3 Outlet Rip Rap Sizing Calculation
(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[ L_p = -0.031 + \frac{T}{1.4} \]
\[ W = 1.5 \text{ ft} \]
\[ Y_t = 0.5 \]
\[ \theta = 45 \]
\[ A_t = 0.7 \]
\[ Q = 1.4 \]
\[ V = 2 \]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. Those criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rock Size
The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron
Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection
The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( (1/(2\tan\theta)) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \frac{1}{2\tan\theta} \left( \frac{A_t}{Y_t} - W \right) \]  \hspace{1cm} \text{Equation 9-11}

Where:
- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( Y_t \) = tailwater depth (ft)
- \( \theta \) = the expansion angle of the culvert flow

and:
\[ A_t = \frac{Q}{V} \]  \hspace{1cm} \text{Equation 9-12}

Where:
- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_t \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q/V\sqrt{H} \) or \( Q/V/H^{1.5} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \% D_p \) or \( \% H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert A6 Outlet Rip Rap Sizing Calculation

(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[ L_p = -0.185 \]
\[ W = 1.5 \text{ ft} \]
\[ V_r = 0.5 \]
\[ \phi = 45 \]
\[ A_t = 0.45 \]
\[ Q = 0.9 \]
\[ V = 2 \]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rock Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( 1/(2\tan \theta) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \left[ \frac{1}{2 \tan \phi} \right] \left( \frac{A_t}{W} \right) \]

Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( V_r \) = tailwater depth (ft)
- \( \phi \) = the expansion angle of the culvert flow

and:

\[ A_t = \frac{Q}{V} \]

Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_t \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( (V/V_r)^{1.5} \), or \( Q/H^2 \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \% D \), or \( \% H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert A10 Outlet Rip Rap Sizing Calculation

(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[
L_p = 3.179 \\
W = 1.5 \text{ ft} \\
Y_r = 0.5 \\
Q = 45 \\
A = 5.9 \\
Q = 11.8 \\
V = 2 \\
T = \text{11.8} \\
D_{50} = 9' - \text{Type L} \\
D_{50} \text{ sizing per UDFCD figure 9.38}
\]

Since \(L_p\) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 12' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rock Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be extended until the velocity has been reduced to an acceptable value. The acceptable maximum velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \(\theta\), of the jet. The velocity is related to the expansion factor, \((1/(2\tan(\theta)))\), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[
L_p = \frac{1}{2 \tan(\theta)} \left( \frac{A_t}{V_r} - W \right) \quad \text{Equation 9-11}
\]

Where:

- \(L_p\) = length of protection (ft)
- \(W\) = width of the conduit (ft, use diameter for circular conduits)
- \(V_r\) = tailwater depth (ft)
- \(\theta\) = the expansion angle of the culvert flow

and:

\[
A_t = \frac{Q}{V} \quad \text{Equation 9-12}
\]

Where:

- \(Q\) = design discharge (cfs)
- \(V\) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \(A_t\) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \(L_p\) be less than \(3H\) or \(3D\), nor does \(A_t\) need to be greater than \(10H\) or \(10D\) whenever the Froude parameter, \((1/(2\tan(\theta)))\), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \(L_p\) required by \% \(D\), or \% \(H\) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert A11 Outlet Rip RAP Sizing Calculation

[Calculation per UDFCD Drainage Criteria Manual Volume 2]

\[ L_p = 2.871 \]
\[ W = 1.5 \text{ ft} \]
\[ V_r = 0.5 \]
\[ \theta = 45 \]
\[ A_r = 5.4 \]
\[ Q = 10.8 \]
\[ V = 2 \]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 11' wide at the extent of the riprap for the pipe outfall

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Reeke Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 8 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( (1/2tan\theta) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \left( \frac{1}{2 \tan \theta} \right) \left( \frac{A_r}{V_r} \right) - W \]

Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( V_r \) = tailwater depth (ft)
- \( \theta \) = the expansion angle of the culvert flow

And:

\[ A_r = \frac{Q}{V} \]

Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_r \) = required area of flow at allowable velocity (ft^2)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q/\sqrt{D^3/2} \) or \( Q/\sqrt{H^3/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \% D \) or \( \% H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert A13 Outlet Rip Rap Sizing Calculation
(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[ L_p = 2.5 \]
\[ W = 1.5 \text{ ft} \]
\[ V_r = 0.5 \]
\[ \Theta = 45 \]
\[ A_r = 4.8 \]
\[ Q = 9.6 \]
\[ V = 2 \]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 10' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-49 or 9-41.

Rack Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extant of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion-resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \Theta \), of the jet. The velocity is related to the expansion factor, \( (1/2 \tan \Theta) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \left( \frac{1}{2 \tan \Theta} \right) \left( \frac{A_r}{V_r} \right) \]

Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( V_r \) = tailwater depth (ft)
- \( \Theta \) = the expansion angle of the culvert flow

and:

\[ A_r = \frac{Q}{V} \]

Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_r \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q/V \sqrt{H} \) or \( Q/V H^{1/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \% \( D_p \) or \% \( H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert B1 Outlet Rip Rap Sizing Calculation  
[Calculation per UDFCD Drainage Criteria Manual Volume 2]

\[ L_p = 0.093 \quad T = 1.8 \]
\[ W = 1.5 \text{ ft} \quad D_{50} = 9' - \text{Type L} \]
\[ Y_1 = 0.5 \quad D_{50} \text{ sizing per UDFCD figure 9.38} \]
\[ C = 45 \]
\[ A_e = 0.9 \]
\[ Q = 1.8 \]
\[ V = 2 \]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduits outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rack Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \((1/(2\tan \theta))\), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \left( \frac{1}{2 \tan \theta} \right) \left( \frac{Q}{V} \right) W \]  
Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( Y_1 \) = tailwater depth (ft)
- \( \theta \) = the expansion angle of the culvert flow

and:

\[ A_e = \frac{Q}{V} \]  
Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_e \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q(V/H)^{1/2} \) or \( Q(V/H)^{1/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \% \( A_e \) or \% \( H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert B2 Outlet Rip Rap Sizing Calculation

(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[
L_p = 0.093 \quad T = 1.8
\]

\[
W = 1.5 \text{ ft} \quad D_{sys} = 9'' \text{ - Type L}
\]

\[
Y_t = 0.5 \quad D_{sys} \text{ sizing per UDFCD figure 9.38}
\]

\[
\theta = 45^\circ \quad A_t = 0.9
\]

\[
Q = 1.8 \quad V = 2
\]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rock Size
The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron
Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection
The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( (1/2 \tan \theta) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[
L_p = \left( \frac{1}{2 \tan \theta} \right) \left( \frac{A_t}{V} \right)
\]

Equation 9-11

Where:

\[
L_p = \text{length of protection (ft)}
\]

\[
W = \text{width of the conduit (ft, use diameter for circular conduits)}
\]

\[
Y_t = \text{tailwater depth (ft)}
\]

\[
\theta = \text{the expansion angle of the culvert flow}
\]

and:

\[
A_t = \frac{Q}{i}
\]

Equation 9-12

Where:

\[
Q = \text{design discharge (cfs)}
\]

\[
V = \text{the allowable non-eroding velocity in the downstream channel (ft/sec)}
\]

\[
A_t = \text{required area of flow at allowable velocity (ft)}
\]

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than \( 3H \) or \( 3D \), nor does \( L_p \) need to be greater than \( 10H \) or \( 10D \) whenever the Froude parameter, \( Q/(WH)^{0.5} \) or \( Q/(HD)^{0.5} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( % D \), or \( % H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert B4 Outlet Rip Rap Sizing Calculation
(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[
\begin{align*}
L_p &= 0.587 \\
W &= 1.5 \text{ ft} \\
V &= 0.5 \\
\text{Q} &= 45 \\
A_\theta &= 1.7 \\
Q &= 3.4 \\
V &= 2 \\
\text{D}_{33} &= 9' - \text{Type L} \\
\text{D}_{33} &= \text{Sizing per UDFCD figure 9.38}
\end{align*}
\]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9.40 or 9.41.

Rack Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be extended until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( 1/(2\tan\theta) \), which can be determined directly using Figure 9-35 or Figure 9.36, by assuming that the expanding jet has a rectangular shape:

\[
L_p = \frac{1}{2 \tan \theta} \left( \frac{A_\theta}{V} \right) - W
\]

Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( V_r \) = tailwater depth (ft)
- \( \theta \) = the expansion angle of the culvert flow

and:

\[
A_\theta = \frac{Q}{V}
\]

Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_\theta \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( QD/H^{5/3} \) or \( QD/P^{2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \% D_p or \% H for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Culvert B9 Outlet Riprap Sizing Calculation

(calculation per UDFCD Drainage Criteria Manual Volume 2)

\[
\begin{align*}
L_p &= 0.34 \\
W &= 1.5 \text{ ft} \\
V_t &= 0.5 \\
\theta &= 45 \\
A_t &= 0.2 \\
Q &= 0.4 \\
V &= 2
\end{align*}
\]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. Those criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rock Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( 1/(2\tan(\theta)) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[
L_p = \frac{1}{2 \tan(\theta)} \left( \frac{A_t}{V_t} - W \right)
\]

Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( V_t \) = tailwater depth (ft)
- \( \theta \) = the expansion angle of the culvert flow

and:

\[
A_t = \frac{Q}{V}
\]

Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-erosing velocity in the downstream channel (ft/sec)
- \( A_t \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameters, \( \sqrt{Q/BW}V^{0.5} \) or \( \sqrt{Q/DS} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \% \) D or \( \% \) H for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Concrete Pan A1 Outlet Rip Rap Sizing Calculation

(Calculation per UDCF Drainage Criteria Manual Volume 2)

\[ L_p = 0.216 \]
\[ W = 1.5 \text{ ft} \]
\[ Y = 0.5 \]
\[ A_s = 0.25 \]
\[ V = 2 \]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 5' wide at the extent of the riprap for the pipe outfall

### 3.2.1 Riprap Approach

This section addresses the use of riprap for erosion protection downstream of conduit outfall structures. Refer to the Open Channels chapter for additional information on applications for conical outfall. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a jet into the outfall use Figure 9-40 or 9-41.

#### Rear Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

#### Configuration of Riprap Approach

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

#### Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion-resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( \frac{1}{H(2\tan \theta)} \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[ L_p = \frac{1}{2 \tan \theta} \left( \frac{A_s}{V_t - W} \right) \]

Equation 9-11

Where:

\( L_p \) = length of protection (ft)

\( W \) = width of the conduit (ft, use diameter for circular conduits)

\( V_t \) = tailwater depth (ft)

\( \theta \) = the expansion angle of the culvert flow

and:

\[ A_s = \frac{Q}{V} \]

Equation 9-12

Where:

\( Q \) = design discharge (cfs)

\( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)

\( A_s \) = required area of flow at allowable velocity (ft²)

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D, whichever the Froude parameter, \( Q/rH^{3/2} \) or \( Q/rD^{1/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \% D \), or \( \% H \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Concrete Pan A2 Outlet Rip Rap Sizing Calculation
(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[ L_p = \frac{1}{2 \tan \theta} \left( \frac{A_r}{V_r} \right) \]  

Equation 9-11

Where:

- \( L_p \) = length of protection (ft)
- \( W \) = width of the conduit (ft, use diameter for circular conduits)
- \( Y_r \) = tailwater depth (ft)
- \( \theta \) = the expansion angle of the culvert flow

and:

\[ A_r = \frac{Q}{V} \]  

Equation 9-12

Where:

- \( Q \) = design discharge (cfs)
- \( V \) = the allowable non-eroding velocity in the downstream channel (ft/sec)
- \( A_r \) = required area of flow at allowable velocity (ft²)

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 8' wide at the extent of the riprap for the pipe outfall.

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. These criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rack Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion-resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \((1/2\tan(0))\), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape.

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q/WH^{1/2} \) or \( Q/D^{1/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \frac{N}{D} \) or \( V \) for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
Crossspan B1 Outlet Rip Rap Sizing Calculation
(Calculation per UDFCD Drainage Criteria Manual Volume 2)

\[
\begin{align*}
L_p &= 0.031 \\
W &= 1.5 \text{ ft} \\
V_r &= 0.5 \\
\theta &= 45 \\
A_r &= 0.8 \\
Q &= 1.6 \\
V &= 2
\end{align*}
\]

Since \( L_p \) is less than 3D, the riprap length shall be equivalent to 3D or 4.5' long.

Riprap has been sized at 4.5' long by 4' wide at the extent of the riprap for the pipe outfall

3.2.1 Riprap Apron

This section addresses the use of riprap for erosion protection downstream of conduit and culvert outlets. Refer to the Open Channels chapter for additional information on applications for and placement of riprap. Those criteria will be useful in design of erosion protection for conduit outlets. When incorporating a drop into the outfall use Figure 9-40 or 9-41.

Rack Size

The procedure for determining the required riprap size downstream of a conduit outlet is outlined in Section 3.2.3.

Configuration of Riprap Apron

Figure 9-34 illustrates typical riprap protection of culverts at conduit outlets.

Extent of Protection

The length of the riprap protection downstream from the outlet depends on the degree of protection desired. If it is necessary to prevent all erosion, the riprap must be continued until the velocity has been reduced to an acceptable value. The acceptable major event velocity is set at 5 ft/sec for non-cohesive soils and at 7 ft/sec for erosion resistant soils. The rate at which the velocity of a jet from a conduit outlet decreases is not well known. For the procedure recommended here, it is assumed to be related to the angle of lateral expansion, \( \theta \), of the jet. The velocity is related to the expansion factor, \( (1/(2\tan \theta)) \), which can be determined directly using Figure 9-35 or Figure 9-36, by assuming that the expanding jet has a rectangular shape:

\[
L_p = \frac{1}{2 \tan \theta} \left( \frac{A_r}{V_r} - W \right)
\]

Equation 9-11

Where:

\[
\begin{align*}
L_p &= \text{length of protection (ft)} \\
W &= \text{width of the conduit (ft, use diameter for circular conduits)} \\
V_r &= \text{tailwater depth (ft)} \\
\theta &= \text{the expansion angle of the culvert flow}
\end{align*}
\]

and:

\[
A_r = \frac{Q}{V_r}
\]

Equation 9-12

Where:

\[
\begin{align*}
Q &= \text{design discharge (cfs)} \\
V_r &= \text{the allowable non-eroding velocity in the downstream channel (ft/sec)} \\
A_r &= \text{required area of flow at allowable velocity (ft)}
\end{align*}
\]

In certain circumstances, Equation 9-11 may yield unreasonable results. Therefore, in no case should \( L_p \) be less than 3H or 3D, nor does \( L_p \) need to be greater than 10H or 10D whenever the Froude parameter, \( Q/WH^{1/2} \) or \( Q/DE^{1/2} \), is less than 8.0 or 6.0, respectively. Whenever the Froude parameter is greater than these maximums, increase the maximum \( L_p \) required by \( \% B \), or \% H for circular or rectangular (box) culverts, respectively, for each whole number by which the Froude parameter is greater than 8.0 or 6.0, respectively.
APPENDIX C

DETENTION POND COMPUTATIONS
## DETENTION VOLUME BY THE MODIFIED FAA METHOD

### Project: Grand Lake Lodge

**Basin ID:** Pond A

**NOTE:** For catchments larger than 90 acres, CUHP&hydrograph and routing are recommended.

#### Determination of MINOR Detection Volume Using Modified FAA Method

<table>
<thead>
<tr>
<th>Design Information (Input):</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment Drainage Imperviousness</td>
<td>L&lt;sub&gt;D&lt;/sub&gt;</td>
<td>30.00 percent</td>
</tr>
<tr>
<td>Groundwater</td>
<td>A</td>
<td>31.810 acres</td>
</tr>
<tr>
<td>Predevelopment NHC Soil Group</td>
<td>Type</td>
<td>A, B, C, or D</td>
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<tr>
<td>Return Period for Detection Control</td>
<td>T</td>
<td>10 years (2, 5, 10, 25, 50, or 100)</td>
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<tr>
<td>Time Interval of Watered</td>
<td>X</td>
<td>32 hours</td>
</tr>
<tr>
<td>Allowable Unit Release Rate</td>
<td>Q&lt;sub&gt;a&lt;/sub&gt;</td>
<td>0.002 inches</td>
</tr>
<tr>
<td>Design Rainfall E/D Formula</td>
<td>i&lt;sub&gt;0&lt;/sub&gt; = C&lt;sub&gt;e&lt;/sub&gt;(P&lt;sub&gt;i&lt;/sub&gt;^2 + C&lt;sub&gt;e&lt;/sub&gt;)/C&lt;sub&gt;e&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Coefficient One</td>
<td>C&lt;sub&gt;e&lt;/sub&gt;</td>
<td>28.50</td>
</tr>
<tr>
<td>Coefficient Two</td>
<td>C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>1.792</td>
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#### Determination of MAJOR Detection Volume Using Modified FAA Method

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<th>Design Information (Input):</th>
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<tr>
<td>Catchment Drainage Imperviousness</td>
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<tr>
<td>Groundwater</td>
<td>A</td>
<td>31.810 acres</td>
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<tr>
<td>Predevelopment NHC Soil Group</td>
<td>Type</td>
<td>A, B, C, or D</td>
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<tr>
<td>Return Period for Detection Control</td>
<td>T</td>
<td>10 years (2, 5, 10, 25, 50, or 100)</td>
</tr>
<tr>
<td>Time Interval of Watered</td>
<td>X</td>
<td>32 hours</td>
</tr>
<tr>
<td>Allowable Unit Release Rate</td>
<td>Q&lt;sub&gt;a&lt;/sub&gt;</td>
<td>0.002 inches</td>
</tr>
<tr>
<td>Design Rainfall E/D Formula</td>
<td>i&lt;sub&gt;0&lt;/sub&gt; = C&lt;sub&gt;e&lt;/sub&gt;(P&lt;sub&gt;i&lt;/sub&gt;^2 + C&lt;sub&gt;e&lt;/sub&gt;)/C&lt;sub&gt;e&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Coefficient One</td>
<td>C&lt;sub&gt;e&lt;/sub&gt;</td>
<td>28.50</td>
</tr>
<tr>
<td>Coefficient Two</td>
<td>C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>1.792</td>
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#### Determination of Average Outflow from the Basin (Calculated):

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<th>Runoff Coefficient</th>
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<th>0.22</th>
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<td>Inflow Peak Runoff</td>
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<td>Allowable Peak Outflow Rate</td>
<td>Q&lt;sub&gt;out&lt;/sub&gt;</td>
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<td>Mod. FAA Minor Storage Volume</td>
<td>V&lt;sub&gt;m&lt;/sub&gt;</td>
<td>17.37 cubic feet</td>
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<tr>
<td>Mod. FAA Major Storage Volume</td>
<td>V&lt;sub&gt;M&lt;/sub&gt;</td>
<td>0.339 acre-ft</td>
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<table>
<thead>
<tr>
<th>Rainfall Duration (minutes)</th>
<th>Rainfall Intensity (inches/hr)</th>
<th>Adjustment Factor (calculated)</th>
<th>Average Outflow Volume (cu-ft)</th>
<th>Storage Volume (cu-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>0.025</td>
<td>0.97</td>
<td>1.90</td>
<td>0.306</td>
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### Determination of Average Outflow from the Basin (Calculated):

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<td>Inflow Peak Runoff</td>
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<td>0.026 acres</td>
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<tr>
<td>Allowable Peak Outflow Rate</td>
<td>Q&lt;sub&gt;out&lt;/sub&gt;</td>
<td>0.83 inches</td>
</tr>
<tr>
<td>Mod. FAA Minor Storage Volume</td>
<td>V&lt;sub&gt;m&lt;/sub&gt;</td>
<td>17.37 cubic feet</td>
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<th>Rainfall Intensity (inches/hr)</th>
<th>Adjustment Factor (calculated)</th>
<th>Average Outflow Volume (cu-ft)</th>
<th>Storage Volume (cu-ft)</th>
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<td>0.97</td>
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<td>120</td>
<td>0.035</td>
<td>0.97</td>
<td>2.65</td>
<td>0.399</td>
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<tr>
<td>90</td>
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<td>0.97</td>
<td>3.24</td>
<td>0.493</td>
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<tr>
<td>60</td>
<td>0.055</td>
<td>0.97</td>
<td>3.61</td>
<td>0.587</td>
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<tr>
<td>30</td>
<td>0.070</td>
<td>0.97</td>
<td>3.90</td>
<td>0.681</td>
</tr>
<tr>
<td>15</td>
<td>0.090</td>
<td>0.97</td>
<td>4.07</td>
<td>0.775</td>
</tr>
<tr>
<td>10</td>
<td>0.110</td>
<td>0.97</td>
<td>4.17</td>
<td>0.870</td>
</tr>
<tr>
<td>5</td>
<td>0.150</td>
<td>0.97</td>
<td>4.49</td>
<td>1.065</td>
</tr>
<tr>
<td>3</td>
<td>0.200</td>
<td>0.97</td>
<td>4.87</td>
<td>1.260</td>
</tr>
<tr>
<td>2</td>
<td>0.300</td>
<td>0.97</td>
<td>5.51</td>
<td>1.710</td>
</tr>
<tr>
<td>1</td>
<td>0.600</td>
<td>0.97</td>
<td>6.77</td>
<td>3.420</td>
</tr>
</tbody>
</table>

---

[Mod. FAA Minor Storage Volume (public) = 17,376 cubic feet]

[Mod. FAA Major Storage Volume (public) = 0.339 acre-ft]

**UDFCD DETENTION BASIN VOLUME ESTIMATING WORKBOOK Version 2.34, Released November 2013**

---

D2535/13-Detention - FAA - Basin A de, Modified FAA

8/30/2018, 12:11 PM
### Stage-Storage Sizing for Detention Basins

**Project:** Grand Lake Ledge  
**Basin ID:** Pond A

#### Design Information (Inputs):  
- Width of Basin Bottom, \( W = \)  
- Length of Basin Bottom, \( L = \)  
- Dam Side-slope (H:V), \( Z_d = \)

#### Check Basin Shape:  
- Right Triangle  
- Isosceles Triangle  
- Rectangle  
- Circle / Ellipse  
- Irregular  
(Use Override values in cells G32:G52)

#### Stage-Storage Relationship:

<table>
<thead>
<tr>
<th>Labels for WCCV, Minor,</th>
<th>Water Surface Elevation (ft)</th>
<th>Side Slope (H:V)</th>
<th>Basin Width at Stage ft</th>
<th>Basin Length at Stage ft</th>
<th>Surface Area at Stage ft²</th>
<th>Surface Area at Stage ft² User Override</th>
<th>Volume Below Stage ft³</th>
<th>Volume Below Stage ft³ User Override</th>
<th>Volume Below Stage acre-ft</th>
<th>Volume Below Stage acre-ft User Override</th>
<th>Target Volumes for WCCV, Minor, &amp; Major Storage Volumes (for goal seek)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6562.50</td>
<td>0.00</td>
<td>0.00</td>
<td>134</td>
<td>19</td>
<td>0.003</td>
<td>0.000</td>
<td>37</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>6562.70</td>
<td>0.00</td>
<td>0.00</td>
<td>137</td>
<td>47</td>
<td>0.003</td>
<td>0.001</td>
<td>225</td>
<td>0.005</td>
<td>0.002</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>6563.10</td>
<td>0.00</td>
<td>0.00</td>
<td>225</td>
<td>84</td>
<td>0.006</td>
<td>0.002</td>
<td>460</td>
<td>0.010</td>
<td>0.003</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>6563.30</td>
<td>0.00</td>
<td>0.00</td>
<td>627</td>
<td>260</td>
<td>0.014</td>
<td>0.008</td>
<td>2,174</td>
<td>0.050</td>
<td>0.012</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>6563.50</td>
<td>0.00</td>
<td>0.00</td>
<td>4,144</td>
<td>1,173</td>
<td>0.066</td>
<td>0.027</td>
<td>6,852</td>
<td>0.157</td>
<td>0.052</td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td>6564.30</td>
<td>0.00</td>
<td>0.00</td>
<td>8,915</td>
<td>3,648</td>
<td>0.206</td>
<td>0.094</td>
<td>10,862</td>
<td>0.245</td>
<td>0.120</td>
<td>0.120</td>
<td></td>
</tr>
<tr>
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<td>0.00</td>
<td>0.00</td>
<td>8,095</td>
<td>8,095</td>
<td>0.281</td>
<td>0.166</td>
<td>13,233</td>
<td>0.304</td>
<td>0.244</td>
<td>0.244</td>
<td></td>
</tr>
<tr>
<td>6565.10</td>
<td>0.00</td>
<td>0.00</td>
<td>13,777</td>
<td>13,340</td>
<td>0.316</td>
<td>0.308</td>
<td>14,275</td>
<td>0.328</td>
<td>0.371</td>
<td>0.371</td>
<td></td>
</tr>
<tr>
<td>WOCV</td>
<td>17,562 ft</td>
<td>0.00</td>
<td>14,729</td>
<td>19,046</td>
<td>0.338</td>
<td>0.437</td>
<td>15,086</td>
<td>0.346</td>
<td>0.500</td>
<td>0.500</td>
<td></td>
</tr>
<tr>
<td>6565.50</td>
<td>0.00</td>
<td>0.00</td>
<td>15,410</td>
<td>22,127</td>
<td>0.354</td>
<td>0.576</td>
<td>15,212</td>
<td>0.361</td>
<td>0.647</td>
<td>0.647</td>
<td></td>
</tr>
<tr>
<td>6566.30</td>
<td>0.00</td>
<td>0.00</td>
<td>16,942</td>
<td>31,366</td>
<td>0.368</td>
<td>0.720</td>
<td>16,167</td>
<td>0.376</td>
<td>0.764</td>
<td>0.764</td>
<td></td>
</tr>
<tr>
<td>30.505 ft</td>
<td>6566.50</td>
<td>0.00</td>
<td>17,695</td>
<td>37,912</td>
<td>0.383</td>
<td>0.870</td>
<td>17,970</td>
<td>0.391</td>
<td>0.948</td>
<td>0.948</td>
<td></td>
</tr>
<tr>
<td>6567.10</td>
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<td>0.00</td>
<td>17,156</td>
<td>44,364</td>
<td>0.498</td>
<td>1.027</td>
<td>17,722</td>
<td>0.407</td>
<td>1.107</td>
<td>1.107</td>
<td></td>
</tr>
<tr>
<td>100-YR</td>
<td>6567.30</td>
<td>0.00</td>
<td>18,055</td>
<td>51,812</td>
<td>0.415</td>
<td>1.189</td>
<td>18,275</td>
<td>0.418</td>
<td>1.231</td>
<td>1.231</td>
<td></td>
</tr>
<tr>
<td>48.635 ft</td>
<td>6576.50</td>
<td>0.30</td>
<td>18,275</td>
<td>53,827</td>
<td>0.418</td>
<td>1.231</td>
<td>18,725</td>
<td>0.418</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:  
- N/A: Not Available
- OR: Optional Row

020379-UD-Detention - FAA - Basin A.xls, Basin  
8/30/2018, 12:51 PM
### Stage-Discharge Sizing of the Water Quality Capture Volume (WQCV) Outlet

**Project:** Grand Lake Lodge  
**Basin ID:** Basin A

#### WQCV Information (Table)

<table>
<thead>
<tr>
<th>WQCV</th>
<th>Stormwater Volume (m³)</th>
<th>Stormwater Flow (m³/s)</th>
<th>Flow Duration (h)</th>
<th>Total Volume (m³)</th>
<th>Total Flow Duration (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.05</td>
<td>0.07</td>
<td>2.5</td>
<td>0.625</td>
<td>2.5</td>
</tr>
</tbody>
</table>

#### WQCV Information (Diagram)

- Water Quality Capture Volume (WQCV)
- Stormwater Capture Volume (SCV)
- Flow Duration (h)

#### WQCV Information (Examples)

- Total opening area at each row based on observed flow. A = 2.5 square meters
- Total opening area at each row based on observed flow. A = 2.5 square meters

#### Control Sections of Rows of Holes in Each Row

<table>
<thead>
<tr>
<th>Row 1</th>
<th>Row 2</th>
<th>Row 3</th>
<th>Row 4</th>
<th>Row 5</th>
<th>Row 6</th>
<th>Row 7</th>
<th>Row 8</th>
<th>Row 9</th>
<th>Row 10</th>
<th>Row 11</th>
<th>Row 12</th>
<th>Row 13</th>
<th>Row 14</th>
<th>Row 15</th>
<th>Row 16</th>
<th>Row 17</th>
<th>Row 18</th>
<th>Row 19</th>
<th>Row 20</th>
<th>Row 21</th>
<th>Row 22</th>
<th>Row 23</th>
<th>Row 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
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<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Collection Capacity for Each Row of Holes in m³/Row

<table>
<thead>
<tr>
<th>Row 1</th>
<th>Row 2</th>
<th>Row 3</th>
<th>Row 4</th>
<th>Row 5</th>
<th>Row 6</th>
<th>Row 7</th>
<th>Row 8</th>
<th>Row 9</th>
<th>Row 10</th>
<th>Row 11</th>
<th>Row 12</th>
<th>Row 13</th>
<th>Row 14</th>
<th>Row 15</th>
<th>Row 16</th>
<th>Row 17</th>
<th>Row 18</th>
<th>Row 19</th>
<th>Row 20</th>
<th>Row 21</th>
<th>Row 22</th>
<th>Row 23</th>
<th>Row 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Area (m²)
**STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)**

**Project:** Grand Lake Lodge  
**Basin ID:** Pend A

Current Routing Order is #3

**Calculation of Collection Capacity:**

- **Net Opening Area (after Trash Rack Reduction):**
  - \( A_n \) = \( \frac{3.97}{5.98} \) = 0.66

- **Top Elevation of Vertical Orifice Opening, Top = 6593.73**

**Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).**

<table>
<thead>
<tr>
<th>Water Surface Elevation</th>
<th>WQCV Plate/Flare</th>
<th>#1 Horiz.</th>
<th>#1 Vert.</th>
<th>#2 Horiz.</th>
<th>#2 Vert.</th>
<th>Total Collection Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(ft.)</td>
<td>(ft.)</td>
<td>(ft.)</td>
<td>(ft.)</td>
<td>(ft.)</td>
<td>(ft.)</td>
</tr>
<tr>
<td>6586.20</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6586.70</td>
<td>0.07</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6588.90</td>
<td>0.08</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6590.10</td>
<td>0.06</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6590.20</td>
<td>0.07</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6590.30</td>
<td>0.08</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6590.40</td>
<td>0.09</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>6590.50</td>
<td>0.10</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>6590.60</td>
<td>0.11</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Horizontal Orifices**

**Vertical Orifices**

**Target Volumes for WQCV, Minor, & Major Storage Values:**

- *Note for goal levels*
RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: Grand Lake Lodge
Basin ID: Pond A

Sizing the Restrictor Plate for Circular Vertical Orifrices or Pipes (Input)
- Water Surface Elevation at Design Depth
- Pipe/Vertical Orifice Entrance Level Elevation
- Required Peak Flow through Orifice at Design Depth
- Pipe/Vertical Orifice Diameter (inches)
- Orifice Coefficient

<table>
<thead>
<tr>
<th>#1 Vertical Orifice</th>
<th>#2 Vertical Orifice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elev: WS = 8.59740 ft</td>
<td>Elev: WS = 8.59740 ft</td>
</tr>
<tr>
<td>Elev: Invert = 6.59248 ft</td>
<td>Elev: Invert = 6.59248 ft</td>
</tr>
<tr>
<td>Q = 18.66 ft³/s</td>
<td>Q = 18.66 ft³/s</td>
</tr>
<tr>
<td>Dia = 24.0 inches</td>
<td>Dia = 24.0 inches</td>
</tr>
<tr>
<td>C₀ = 0.50</td>
<td>C₀ = 0.50</td>
</tr>
</tbody>
</table>

Full-flow Capacity (Calculated)
- Full-flow area
- Half Central Angle in Radians
- Full-flow capacity

Calculation of Orifice Flow Condition
- Half Central Angle (0°-Theta≤3.1416)
- Flow area
- Top width of Orifice (inches)
- Height from Invert of Orifice to Bottom of Plate (feet)
- Elevation of Bottom of Plate
- Resistant Peak Flow Through Orifice at Design Depth

<table>
<thead>
<tr>
<th></th>
<th>#1 Vertical Orifice</th>
<th>#2 Vertical Orifice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Af =</td>
<td>3.14 sq ft</td>
<td>3.14 rad</td>
</tr>
<tr>
<td>Theta =</td>
<td>1.72 rad</td>
<td>1.72 rad</td>
</tr>
<tr>
<td>Qf =</td>
<td>35.2 ft³/s</td>
<td>35.2 ft³/s</td>
</tr>
<tr>
<td>Percent of Design Flow =</td>
<td>160%</td>
<td>160%</td>
</tr>
<tr>
<td>Theta =</td>
<td>1.72 rad</td>
<td>1.72 rad</td>
</tr>
<tr>
<td>A₀ =</td>
<td>1.96 sq ft</td>
<td>1.96 sq ft</td>
</tr>
<tr>
<td>T₀ =</td>
<td>23.74 inches</td>
<td>23.74 inches</td>
</tr>
<tr>
<td>Y₀ =</td>
<td>1.15 feet</td>
<td>1.15 feet</td>
</tr>
<tr>
<td>Elev Plate Bottom Edge =</td>
<td>8.59363 ft</td>
<td>8.59363 ft</td>
</tr>
<tr>
<td>Q₀ =</td>
<td>18.7 ft³/s</td>
<td>18.7 ft³/s</td>
</tr>
<tr>
<td>Equivalent Width =</td>
<td>1.82 ft</td>
<td>1.82 ft</td>
</tr>
<tr>
<td>Equiv. Centroid El. =</td>
<td>8.59306 ft</td>
<td>8.59306 ft</td>
</tr>
</tbody>
</table>

Width of Equivalent Rectangular Orifice
Centroid Elevation of Equivalent Rectangular Vertical Orifice
**Worksheet for Pond A Spillway**

**Project Description**

Solve For: Headwater Elevation

**Input Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge</td>
<td>19.92 ft/s</td>
</tr>
<tr>
<td>Crest Elevation</td>
<td>8597.40 ft</td>
</tr>
<tr>
<td>Tailwater Elevation</td>
<td>8590.00 ft</td>
</tr>
<tr>
<td>Crest Surface Type</td>
<td>Gravel</td>
</tr>
<tr>
<td>Crest Breadth</td>
<td>8.00 ft</td>
</tr>
<tr>
<td>Crest Length</td>
<td>70.00 ft</td>
</tr>
</tbody>
</table>

**Results**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwater Elevation</td>
<td>8597.63 ft</td>
</tr>
<tr>
<td>Headwater Height Above Crest</td>
<td>0.23 ft</td>
</tr>
<tr>
<td>Tailwater Height Above Crest</td>
<td>-7.40 ft</td>
</tr>
<tr>
<td>Weir Coefficient</td>
<td>2.60 US</td>
</tr>
<tr>
<td>Submergence Factor</td>
<td>1.00</td>
</tr>
<tr>
<td>Adjusted Weir Coefficient</td>
<td>2.60 US</td>
</tr>
<tr>
<td>Flow Area</td>
<td>16.03 ft²</td>
</tr>
<tr>
<td>Velocity</td>
<td>1.24 ft/s</td>
</tr>
<tr>
<td>Wetted Perimeter</td>
<td>70.46 ft</td>
</tr>
<tr>
<td>Top Width</td>
<td>70.00 ft</td>
</tr>
</tbody>
</table>
**Project:** Grand Lake Lodge  
**Basin ID:** Pond B  
*(For catchments less than 160 acres only. For larger catchments, use hydrograph routing method) (NOTE: For catchments larger than 90 acres, CUNP hydrograph and routing are recommended)*

### Determination of MINOR Detention Volume Using Modified FAA Method

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff Coefficient (C)</td>
<td>0.26</td>
</tr>
<tr>
<td>Inflow Peak Runoff</td>
<td>Qpeak</td>
</tr>
<tr>
<td>Allowable Peak Outflow Rate (Qpeak)</td>
<td>0.32</td>
</tr>
</tbody>
</table>

### Determination of MAJOR Detention Volume Using Modified FAA Method

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runoff Coefficient (C)</td>
<td>0.37</td>
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### Determination of Average Outflow from the Basin (Calculated)

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<tr>
<td>Runoff Intensity (.in/hr)</td>
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<tr>
<td>Average Outflow (cfs)</td>
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<tr>
<td>Storage Volume (acre-feet)</td>
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### Determination of Average Outflow from the Basin (Calculated)

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DETENTION VOLUME BY THE MODIFIED FAA METHOD

Project: Grand Lake Lodge
Basin ID: Pond B

Inflow and Outflow Volumes vs. Rainfall Duration

Volume (acre-feet)

Duration (Minutes)

UDFCD DETENTION BASIN VOLUME ESTIMATING WORKBOOK Version 2.34, Released November 2013
**Stage-Storage Relationship:**

<table>
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<tr>
<th>WQCV (input)</th>
<th>Stages (input)</th>
<th>Water Surface</th>
<th>Side Slope (H:V)</th>
<th>Basin Width at Stage (ft)</th>
<th>Basin Length at Stage (ft)</th>
<th>Storage Requirement from Sheet &quot;Modified FAA&quot;</th>
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**Stage-Storage Relationship:**

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<th>Storage Requirement from Sheet &quot;Full-Spectrum&quot;</th>
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STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

**Project:** Grand Lake Lodge  
**Basin ID:** Pond B

| Current Routing Order is #3 |

**Design Information (Inlet):**
- **Circular Opening:**
  - Diameter in Inches: D
- **Rectangular Opening:**
  - Width in Feet: W
  - Length (Height for Vertical): L
  - Percentage of Open Area After Trash Rack Reduction
  - Orifice Coefficient: C_o
  - Weir Coefficient: C_w
  - Orifice Elevation (Bottom for Vertical)

| Calculation of Collection Capacity: |
- **Net Opening Area (after Trash Rack Reduction):**
- **Optional: User-Defined Net Opening Area**
- **Perimeter as Weir Length:**
- **Optional: User-Defined Weir Length**

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

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<th>Water Surface Elevation (ft NAD83)</th>
<th>Water Level</th>
<th>WQCV Plate/Filter</th>
<th>#1 Horiz.</th>
<th>#2 Horiz.</th>
<th>#1 Vert.</th>
<th>#2 Vert.</th>
<th>Total Collection Capacity (cfs)</th>
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| Target Volumes for WQCV Minor, & Major Storage Volumes (cfs for gross level): 10-YR | 100-YR |
|-------------------------------|--------|-------------------------------|--------|
| 4.15                           | 4.15   | 4.15                           | 4.15   |
| 4.22                           | 4.22   | 4.22                           | 4.22   |
| 4.26                           | 4.26   | 4.26                           | 4.26   |
| 4.34                           | 4.34   | 4.34                           | 4.34   |
| 4.45                           | 4.45   | 4.45                           | 4.45   |
| 4.57                           | 4.57   | 4.57                           | 4.57   |
| 4.68                           | 4.68   | 4.68                           | 4.68   |
| 4.76                           | 4.76   | 4.76                           | 4.76   |

C20178-UD-Detention - FAA - Basin B.xls, Outlet  
8/30/2018, 12:54 PM
STAGE-DISCHARGE CURVE FOR THE OUTLET STRUCTURE
RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: Grand Lake Lodge
Basin ID: Pond B

Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)
- Water Surface Elevation at Design Depth
- Pipe/Vertical Orifice Entrance Invert Elevation
- Required Peak Flow through Orifice at Design Depth
- Pipe/Vertical Orifice Diameter (inches)
- Orifice Coefficient

Full-Flow Capacity (Calculated)
- Full-flow area
- Half Central Angle in Radians
- Full-flow capacity

Calculation of Orifice Flow Condition
- Half Central Angle (θ=θ=0.1416)
- Flow area
- Top width of Orifice (inches)
- Height from Invert of Orifice to Bottom of Plate (feet)
- Elevation of Bottom of Plate
- Resultant Peak Flow Through Orifice at Design Depth

Width of Equivalent Rectangular Vertical Orifice
- Centroid Elevation of Equivalent Rectangular Vertical Orifice

<table>
<thead>
<tr>
<th>#1 Vertical Orifice</th>
<th>#2 Vertical Orifice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elev. WS = 6.508.40</td>
<td>Elev. WS = 6.594.33</td>
</tr>
<tr>
<td>Q = 4.52</td>
<td>Q = 4.65</td>
</tr>
<tr>
<td>D= 18.0</td>
<td>D= 18.0</td>
</tr>
<tr>
<td>C0 = 0.63</td>
<td>C0 = 0.63</td>
</tr>
</tbody>
</table>

| AI = 1.77 | sq ft |
| Theta = 3.14 | rad |
| Qf = 16.0 | cfs |
| Percent of Design Flow = 355% |

| Theta = 1.18 | rad |
| A = 0.79 | sq ft |
| T = 16.64 | inches |
| Y = 0.45 | feet |
| Elev. Plate Bottom Edge = 8.594.66 | feet |

| Equiv. Width = 1.02 | feet |
| Equiv. Centroid El. = 8.594.33 | feet |
Collection Capacity of Horizontal Orifice (Inlet Control)

Project: Grand Lake Lodge
Basin ID: Pond B - Emergency Overflow Structure

Design Information (Input):
Circular Opening:
- Diameter: Dia. = ______ ft.
OR
Rectangular Opening:
- Width: W = 2.92 ft.
- Length: L = 2.92 ft.

Percentage of Open Area After Trash Rack Reduction:
- % open = 50.00 %
- Orifice Coefficient: C_o = 0.67
- Weir Coefficient: C_w = 3.00
- Orifice Elevation: E_o = 8598.40 ft.

Calculation of Collection Capacity:
Net Opening Area (after Trash Rack Reduction) A_o = ______ sq. ft.
Perimeter as Weir Length L_w = ______ ft.

Enter water surface elevations in ascending order:

<table>
<thead>
<tr>
<th>Water Surface Elevation (ft)</th>
<th>Weir Flow (cfs)</th>
<th>Orifice Flow (cfs)</th>
<th>Collection Capacity (cfs)</th>
</tr>
</thead>
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<tr>
<td>start 8598.40</td>
<td>0.00</td>
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</tr>
</tbody>
</table>

<= Greater than inflow, 6.12 cfs
APPENDIX D
REFERENCED INFORMATION
MAP LEGEND

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

AO

B

B0

C

C0

D

Not rated or not available

Water Features

Streams and Canals

Transportation

+++ Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Not rated or not available

Soil Rating Lines

A

AO

B

B0

C

C0

D

Not rated or not available

Soil Rating Points

A

AO

B

B0

D

Not rated or not available

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: Web Mercator (EPSG 3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grand County Area, Colorado
Survey Area Data: Version 11, Oct 10, 2017

Soil Survey Area: Rocky Mountain National Park, Colorado, Parts of Boulder, Grand, and Larimer Counties
Survey Area Data: Version 9, Oct 11, 2017

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 14, 2014—Nov 19, 2016

USDA Natural Resources Conservation Service
Web Soil Survey
National Cooperative Soil Survey

3/15/2018 Page 2 of 5
Hydrologic Soil Group—Grand County Area, Colorado; and Rocky Mountain National Park, Colorado; Parts of Boulder, Grand, and Larimer Counties
(Grand Lake Lodge Soil Report)

<table>
<thead>
<tr>
<th>MAP LEGEND</th>
<th>MAP INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.</td>
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## Hydrologic Soil Group

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<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
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<tr>
<td>75</td>
<td>Scout cobbly sandy loam, 6 to 15 percent slopes</td>
<td>A</td>
<td>4.1</td>
<td>14.8%</td>
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<tr>
<td>76</td>
<td>Scout cobbly sandy loam, 15 to 65 percent slopes</td>
<td>A</td>
<td>8.8</td>
<td>31.9%</td>
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<tr>
<td><strong>Subtotals for Soil Survey Area</strong></td>
<td></td>
<td></td>
<td><strong>12.9</strong></td>
<td><strong>46.7%</strong></td>
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<tr>
<td><strong>Totals for Area of interest</strong></td>
<td></td>
<td></td>
<td><strong>27.6</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Enentah very stony loam, 10 to 40 percent slopes</td>
<td>A</td>
<td>14.7</td>
<td>53.3%</td>
</tr>
<tr>
<td><strong>Subtotals for Soil Survey Area</strong></td>
<td></td>
<td></td>
<td><strong>14.7</strong></td>
<td><strong>53.3%</strong></td>
</tr>
<tr>
<td><strong>Totals for Area of interest</strong></td>
<td></td>
<td></td>
<td><strong>27.6</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher
Grand Lake Lodge

March 27, 2018

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or correctness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.
APPENDIX E
DRAINAGE MAPS
Report
Phase I Environmental Assessment

Grand Lake Lodge
15500 U.S. Highway 34
Grand Lake, Colorado

Prepared For
USBank

July 5, 2011

CORN &
ASSOCIATES
ENVIRONMENTAL MANAGEMENT

3625 Raleigh Street • Denver, Colorado 80212 • (303) 433-8577
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General Information

**Project Information:**
- 11-004022-02 - Grand Lake Lodge
- **Project Number:** USB-667
- **RIMS Project #:** 11-004022-02

**Site Information:**
- Grand Lake Lodge
- 15500 U.S. Highway 34
- Grand Lake, CO 80447
- **County:** Grand
- **Latitude, Longitude:** 40.256500, -105.826600

**Consultant Information:**
- Corn and Associates
- 3625 Raleigh Street
- Denver, CO 80212
- **Phone:** (303) 433-8577
- **Fax:** (303) 455-1123
- **E-mail Address:** fredcorn@comcast.net
- **Inspection Date:** 06/14/2011
- **Report Date:** 07/05/2011

**Client Information:**
- US Bank
- Karla Thomas
- 950 17th St., 12th Floor
- Denver, CO 80202

**Site Assessor:**

[Signature]

Frederick Corn
P.E.

**Senior Reviewer:**

[Signature]

Frederick Corn
P.E.

**EP Certification:**

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in 312.10 of this part.

[Signature]

Frederick Corn - P.E.

**Standard Certification:**

I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

[Signature]

Frederick Corn - P.E.
2.0 Introduction

2.1 Purpose

The following conditions apply to the completion of this Phase One Environmental Site Assessment:

- The purpose of this report is to identify recognized environmental conditions of the subject property in conjunction with the ASTM E 1527 Standard Practice for Environmental Site Assessments.

- A recognized environmental condition is defined under the ASTM Standard as the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

- The ASTM E 1527 standard practice is designed to define good commercial and customary practice in the United States of America for conducting an environmental site assessment of a parcel of commercial real estate with respect to the range of contaminants within the scope of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products.

- This ASTM standard practice is intended to constitute “all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice” (42 USC § 9601 (35)(B)).

2.2 Scope of Services

The Phase I ESA conducted at the Subject Property was in general accordance with ASTM Standard E 1527-05 and included the following:

- Review of previous environmental site assessments;
- Records review;
- Interviews with regulatory officials and personnel associated with the subject and adjoining properties;
- A site visit; and
- Evaluation of information and preparation of the report provided herein.

Typically, a Phase I ESA does not include sampling or testing of air, soil, groundwater, surface water, or building materials. These activities would be carried out in a Phase II ESA, if required. For this Phase I ESA, no additions to the ASTM E 1527-05 standard were made with the exception of the following: None.

This document has been prepared in accordance with the specifications set forth in the US Bancorp assignment letter dated June 7, 2011 for the subject property.

2.3 Deviations

No deviations from the recommended scope of ASTM Standard E 1527-05 were performed as part of this Phase I ESA with the exception of any additions noted in Detailed Scope of Services.

2.4 Limitations

This Phase I Environmental Site Assessment was conducted in accordance with current industry standards and practices. Corn & Associates conducted this assessment specifically for the use of U.S. Bancorp and their authorized representatives. Any reliance on this report by another party shall be at such party's sole risk.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. The conclusions and recommendations presented represent Corn & Associates' best judgment based on the data obtained from the work. Due to the nature of the investigation and the limited data available, Corn & Associates cannot warrant against undiscovered environmental liabilities that are beyond the scope of a Phase I ESA. A Phase I ESA is not an all encompassing investigation. It is a professional investigation with a limited scope based on reasonably obtainable information that an experienced professional practicing due care could be expected to obtain or observe and evaluate. Conclusions and recommendations presented in this report should not be construed as legal advice.
2.0 Introduction (continued)
2.4 Limitations (continued)

As our work included review of information provided by others, we assume no responsibility for conditions not revealed or observed during our investigation or for conditions not generally recognized as environmentally unacceptable at the time this report was prepared. The information, conclusions, and recommendations provided herein apply only to the subject property as it existed during Corn & Associates' site reconnaissance. Should site use or conditions change, information, conclusions, and recommendations herein no longer apply.

2.5 Reliance

This report has been prepared for the sole benefit of U.S. Bancorp, the client. The report may not be relied upon by any other person or entity without the express written consent of Corn & Associates and U.S. Bancorp.
3.0 Subject Property Description
3.1 Location and Legal Description

The subject property includes approximately 50 acres located at 15500 US Highway 34 in Grand Lake, Colorado. The subject property is located adjacent to Rocky Mountain National Park. It is located in Sections 5 and 6, Township 3 North, and Sections 31 and 32, Township 4 North, Range 75 West of the 6th Principal Meridian, County of Grand, State of Colorado.

3.2 Activity and Use Limitations

No environmental liens or activity and use limitations (AULs) were reported for the subject property. The property is zoned PD for Planned Development by Grand County. The Main Lodge at Grand Lake Lodge is a registered National Historic Landmark.

3.3 Physical Setting

The subject property is located at the north end of the Town of Grand Lake at an elevation of approximately 8,620 feet above mean sea level. The property, which slopes steeply from north to south, is located on the south side of Tonahutu Ridge. Rocky Mountain National Park is located immediately north of the subject property.

Geology

The subject property is located on a steep ridge north of Grand and Shadow Mountain Lakes, on the east side of Kawuneeche Valley. The Kawuneeche Valley is a long, straight, glaciated valley near the source of the Colorado River. Grand Lake, located approximately 1/3 mile south of the property, is a natural lake dammed by the lateral moraine of the former Kawuneeche Valley glacier. The immediate vicinity of the property is characterized by metamorphic gneiss and schist.

Hydrogeology

Corn & Associates was unable to determine the exact depth to groundwater at the subject property. Shallow groundwater in the immediate vicinity is limited; flow is expected to follow the topography and flow to the south.

Surface water

The nearest significant surface water features are Tonahutu Creek, which flows from north to south approximately 1/2 mile east of the subject property; Little Columbine Creek which flows from northwest to southeast approximately 1/2 mile south west of the subject property; and Shadow Mountain Lake and Grand Lake, which are located approximately 1/3 mile south of the subject property.

3.4 Subject Property and Vicinity Characteristics

North:  The subject property is bordered on the north by Rocky Mountain National Park.

South:  The subject property is bordered on the south by single-family residential properties.

East:  The subject property is bordered on the east by several single-family houses in the Tonahutu Ridge subdivision.

West:  The subject property is bordered on the west by Rocky Mountain National Park.

No evidence of spills, releases, or other environmental conditions was observed on any properties in the vicinity of the site.
3.0 Subject Property Description (continued)

3.5 Description of Subject Property Structures and Improvements

The subject property includes approximately 50 acres located at 15500 US Highway 34 in Grand Lake, Colorado. It is occupied by Grand Lake Lodge, a hotel facility that was developed in 1920 as a concession area for Rocky Mountain National Park. The largest facility at the subject property is the Main Lodge, which was significantly reconstructed after a major fire in 1973. The Main Lodge includes the hotel lobby, a restaurant and kitchen, and an employee dining room. A partial, walk-out basement is divided into several small offices and storage rooms, and a game room for guests. A pool and a large pavilion that is used for weddings and other functions, are located near the Main Lodge.

In addition to the Main Lodge, the subject property includes two smaller lodges. Moose Lodge is a single-story log structure that is finished as a conference center. The meeting rooms are currently used for storage. Elk Lodge is a 2-story log structure that is used for groups with up to 20 people. Elk Lodge is also winterized and is used as winter office space when the rest of the facility is closed.

Grand Lake Lodge includes 57 guest rooms in cabins that are accessed by a small paved road that winds up onto Tonahutu Ridge, behind the Main Lodge. The cabins are finished with either one or two units in each. Nineteen units have been extensively remodeled in 2011, including new bathrooms and new flooring. The property also includes approximately 50 smaller cabins that have historically been used as employee housing. Approximately 44 people are currently housed in 22 of the cabins, and one cabin is being used as an office. The employee cabins have not been renovated since the 1960s or 1970s.

Three water towers are located at the top of the ridge, at the north end of the property. One tower is used to store fire suppression water for Grand Lake Lodge; a second tank is owned by the Town of Grand Lake; and the third tower is damaged and no longer in use.

Several structures that are used as maintenance facilities, and a maintenance yard that includes two large roll-off containers for trash, are located in the northwest corner of the subject property, along Tonahutu Ridge Road. The maintenance shop is located in a building called the Mill. The shop is used mostly for wood-working; however it also includes a garage where an old fire truck is parked. Corn & Associates observed two small cans of gasoline and several buckets of oil in the shop. Two small buildings next to the Mill are used for lumber and firewood storage. An old barn near the Mill is currently used to store construction equipment, carpet, kitchen fixtures and appliances, and roofing materials.

Two 285-gallon aboveground fuel storage tanks are located in the maintenance yard. The tanks, one for gasoline and one for diesel fuel, include small drip pans, but no secondary containment. Corn & Associates did not observe any staining or other indications of spills or releases.

Portions of the subject property not occupied by lodges, cabins, or maintenance facilities, were historically heavily wooded. However, in recent years the lodgepole pine have been decimated by beetles, and this year the owners of the property have made significant progress in removing beetle-killed trees. Piles of dead wood are located throughout the property, including in the dry bed of a pond that is located at the west end of the site.

3.6 Current Uses of the Subject Property

The subject property includes approximately 50 acres located at 15500 US Highway 34 in Grand Lake, Colorado. It is occupied by Grand Lake Lodge, a hotel facility that was developed in 1920 as a concession area for Rocky Mountain National Park. The largest facility at the subject property is the Main Lodge, which includes the hotel lobby, a restaurant and kitchen, and an employee dining room. In addition to the Main Lodge, the subject property includes two smaller lodges, a pool, a pavilion for weddings and events, and 57 guest rooms in cabins that are finished with either one or two units in each. The property also includes approximately 50 smaller cabins that have historically been used as employee housing.

Several structures that are used as maintenance facilities, and a maintenance yard that includes two large roll-off containers for trash, are located in the northwest corner of the subject property, along Tonahutu Ridge Road. Portions of the subject property not occupied by lodges, cabins, or maintenance facilities, were historically heavily wooded. However, in recent years the lodgepole pine have been decimated by beetles. Beetle-killed trees are currently being removed, and piles of dead wood are located throughout the property.
4.0 User Provided Information

4.1 Environmental Liens

No environmental liens were reported for the subject property.

4.2 Environmental Reports or Investigations

No environmental reports or investigations were provided.

4.3 Experience of User

The user did not report any specialized knowledge or experience that suggests an environmental concern or recognized environmental conditions in connection with the subject property.
5.0 Historical Use Information

5.1 Historical Background

An interview with Mr. Jeff Larson, General Manager for Grand Lake Lodge and representative of Grand Lake Ventures, LLC, the owner of the subject property; the Grand County Assessor's files; U.S. Geological Survey maps from 1958 and 1978; the Grand Lake Lodge website; and historical aerial photographs available at Colorado Aerial Photograph Services in Denver were used to research site history. Four sets of photographs were reviewed: September 10, 1946; April 24, 1981; October 12, 1996; and September 27, 2001.

5.2 Subject Property

The subject property is located on the north side of the Town of Grand Lake, which was surveyed and platted in 1881. Rocky Mountain National Park was created in 1915, and Grand Lake Lodge opened on the subject property in 1920 as a concession area for the park. For many years the Lodge was located within park boundaries; however the property was later annexed into the Town of Grand Lake.

The Lodge was operated by Roe Emery until the 1950s, when it was purchased by I.B. and Ted L. James. The James family operated the Lodge until 1973, when an extensive fire forced the family to close the business. It remained closed for seven years during restoration, and re-opened in 1981. In 1993 the lodge was designated as a National Historic Landmark. In December 2010 the current owner, Grand Lake Ventures LLC, purchased the subject property.

5.3 Adjoining Properties

The subject property is located on the north side of the Town of Grand Lake, which was surveyed and platted in 1881. Rocky Mountain National Park was created in 1915, and Grand Lake Lodge opened on the subject property in 1920 as a concession area for the park. For many years the Lodge was located within park boundaries; however the property was later annexed into the Town of Grand Lake.

Several acres immediately east of the subject property were once part of the Grand Lake Lodge property. However, that area was recently re-platted and developed as the Tonahutu Ridge Subdivision. There are currently four or five luxury homes completed in the subdivision.

5.4 Historically Significant or Environmental Findings

No historically significant or environmental findings were discovered within the scope of this investigation in connection with the subject property or adjoining properties.
6.0 Federal, State, Local & Tribal Database Listings

An ASTM-compliant government records radial database report was obtained for this assessment. The following standard Federal database listings were searched if available: National Priorities List (NPL), Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS and CERCLIS-NFRAP), Resource Conservation and Recovery Information System - Treatment, Storage, and Disposal Facilities (RCRIS-TSD), RCRIS - Large and Small Quantity Generators (RCRIS-Generator), RCRIS Corrective Action Data (CORRACTS), RCRIS Notifiers (NOTIFIERS) and Emergency Response Notification System (ERNS). Criteria for being listed on each database and specific facility information are reviewed within the database report (see Appendix E).

Due to the size of the subject property, the search radii for the various databases were extended by 1/2 mile. Various environmental sites, including several LUST sites, were identified within their respective search radii. These sites either have been issued "No Further Action Required" letters by the Colorado Department of Labor and Employment Division of Oil and Public Safety or due their distance and direction, are not considered to have the potential to impact the subject property. The environmental database report also identifies "unmapped" sites that could not be located either because of a lack of information provided or Environmental Data Resources' mapping capabilities. Twenty-five unmapped sites, including AST, UST, LUST, RCRIS, ERNS, CERCLIS, and landfill sites were identified by the EDR report. Based on the information provided, none of these sites appear to be in the vicinity of the subject property.

<table>
<thead>
<tr>
<th>Database List</th>
<th>Subject Property Listings</th>
<th>Total Number of Listings</th>
<th>Environmental Concern Posed to the Subject Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal NPL Sites (&lt; 1 mile)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Federal CERCLIS Sites (&lt; 0.5 mile)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Federal CERCLIS NFRAP Sites</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Federal CERCLIS NFRAP Sites (Property &amp; Adjoining)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>RCRA CORRACTS Sites (&lt; 1 mile)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>RCRA TSD Facilities (&lt; 0.5 mile)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>RCRA SOG (Target &amp; Adjacent)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>RCRA LOG (Target &amp; Adjacent)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Federal ERNS Sites (Target Property Only)</td>
<td>0</td>
<td>N/A</td>
<td>None</td>
</tr>
<tr>
<td>State HW Sites (&lt; 1 mile)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>State CERCLIS Sites (&lt; 0.5 mile)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Landfill/SW Disposal Sites (&lt; 0.5 mile)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>LUST Sites (&lt; 0.5 mile)</td>
<td>0</td>
<td>4</td>
<td>None</td>
</tr>
<tr>
<td>UST/AST Sites (Property &amp; Adjacent)</td>
<td>0</td>
<td>15</td>
<td>None</td>
</tr>
<tr>
<td>State VCP Sites (&lt; 0.5 mile)</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
</tbody>
</table>
7.0 Site Reconnaissance

7.1 Hazardous Substances

No hazardous substances that constitute evidence of a *recognized environmental condition* were observed at the subject property at the time of the site reconnaissance.

7.2 Unidentified Containers

No unidentified containers that constitute evidence of a *recognized environmental condition* were observed at the subject property at the time of the site reconnaissance.

7.3 Staining

No unidentified staining that constitutes evidence of a *recognized environmental condition* was observed at the subject property at the time of the site reconnaissance.

7.4 Stressed Vegetation

No unidentified stressed vegetation that constitutes evidence of a *recognized environmental condition* was observed at the subject property at the time of the site reconnaissance.

7.5 Aboveground Storage Tanks (ASTs)

Two aboveground storage tanks located in the maintenance yard at the subject property are used to store gasoline and diesel fuel. The 285-gallon, single-walled, steel tanks include small drip pans, but not adequate secondary containment. Corn & Associates did not observe any staining or other indications of spills or releases.

7.6 Underground Storage Tanks (USTs)

Regulatory records review did not indicate the current registration of USTs at the subject property, and no evidence of vent pipes, fill pipes, or access ways indicating USTs was discovered at the time of the site reconnaissance.

7.7 Pits, Ponds, And Lagoons

No pits, ponds or lagoons associated with onsite processes were observed at the subject property at the time of the site reconnaissance.

7.8 PCB-Containing Equipment

No PCB-containing equipment was identified during the site reconnaissance.

7.9 Solid Waste Disposal

No indications of improper disposal of solid waste or burial activities were noted within the scope of this investigation.

7.10 Wetlands

No natural standing bodies of water or typically hydrophytic vegetation were observed on the subject property during the site reconnaissance.
7.0 Site Reconnaissance (continued)
7.11 Septic System with On-Site Drainfield
There are no septic systems or on-site drainfields at the subject property.

7.12 Oil/Water Separator
Corn & Associates did not observe any oil/water separators at the subject property.

7.13 Dry Wells or Injection Wells
No dry wells or injection wells were observed on the subject property at the time of the site reconnaissance.

7.14 Contamination of Soil
Corn & Associates did not find any evidence of soil contamination at the subject property, nor was any contaminated soil observed at the time of the site reconnaissance.

7.15 Contamination of Groundwater
Corn & Associates did not find any evidence of groundwater contamination at the subject property.

7.16 Vapor Intrusion
No evidence of contamination which would suggest the potential impact of vapor intrusion on the subject property was noted within the scope of this investigation.

7.17 Use of Pesticides on Site
No evidence of pesticide use was observed on the subject property at the time of the site reconnaissance.

7.18 Other Concerns
7.18.1 Asbestos
A visual screening for suspect asbestos-containing materials was conducted at the time of the site reconnaissance. Suspect materials observed include, but may not be limited to, ceiling tile, and flooring and mastic in the lodges, guest cabins, and employee cabins. Although approximately 1/3 of the guest rooms have been recently upgraded, the others include suspect ACM flooring and ceiling materials from 30- to 50-year old remodels. During the site reconnaissance, these materials appeared to be in good condition.

Corn & Associates' inspection did not include observations for hidden materials such as materials under existing floors or behind walls. Also, roofing materials were not observed. Given the 1920s construction date of many of the buildings on the subject property, it is possible that asbestos is present in these materials. However, the absence of asbestos can only be confirmed through sampling and laboratory analysis. As such, all suspect materials should be assumed to contain asbestos until testing proves otherwise. In the event of renovation or demolition, which would disturb these materials, a certified asbestos building inspector should perform an asbestos survey.

7.18.2 Lead
A visual screening for lead-based paint was conducted at the time of the site reconnaissance. Because the buildings on the subject property were constructed prior to 1978 it is possible that there are lead based paints present. However, most window sills and door jambs observed in the guest rooms are not painted.
7.0 Site Reconnaissance (continued)
7.18 Other Concerns (continued)

7.18.3 Radon

The EPA has designated three zones of classification indicating the predicted average indoor screening level of radon per county. Grand County, Colorado is classified in Zone 1 (high potential) which indicates a predicted level greater than 4 picoCuries per liter of air (pCi/L). The EPA “Action Level” is 4 pCi/L. Based on the commercial nature of the property and the lack of subsurface areas, radon does not appear to be a concern. However, testing is required to determine site-specific radon levels.

7.18.4 Lead in Drinking Water

Lead containing materials were banned from use in public water systems, including plumbing connections, in 1986. The buildings on the subject property were constructed prior to 1986. Based on the construction dates, the potential for lead in drinking water exists, however, potable water testing and assessment was not performed.

7.18.5 Mold

Corn & Associates did not sample the subject property for mold. Accessible interior areas of the three lodges, and several representative guest cabins were inspected for evidence of excessive or amplified mold growth. Corn & Associates did not observe any water damage or intrusions, or other conditions favorable for mold growth.

7.18.6 All Other Concerns

No other areas of environmental concern were noted within the scope of this investigation.
8.0 Interviews

Corn & Associates interviewed Ms. Patty Herrera with the Colorado Department of Labor and Employment Division of Oil and Public Safety; and Mr. Jeff Larson, General Manager for Grand Lake Lodge and representative of Grand Lake Ventures, LLC, the owner of the subject property. Corn & Associates was unable to interview any previous owners.
UTILITY REPORT
FOR
GRAND LAKE LODGE
15500 US HIGHWAY 34
GRAND LAKE, COLORADO

Project Number: 020379-01-001

Prepared for:
RTA Grand Lake Lodge II, LLC
2082 Michelson Drive, 4th Fl.
Irvine, CA 92612

Contact: Francis Corso
Phone: (949) 560-4789

Prepared by:

Bowman
CONSULTING

603 Park Point Drive, Suite 100
Golden, Colorado 80401

Contact: Christopher Perdue, P.E.
Phone: 303-801-2934

020379-01-001
June 26, 2018
REVISED: December 21, 2018
ENGINEER’S STATEMENT:
The enclosed utility report, and exhibits, were prepared by me or under my direct supervision and is correct to the best of my knowledge and belief. Said utility report has been prepared in accordance with applicable Three Lakes Water and Sanitation District Rules and Regulations. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in preparing this report.

Christopher Perdue, PE.
State of Colorado No. 50745
For and on Behalf of Bowman Consulting, Ltd.

OWNER/DEVELOPER STATEMENT:
As Owner/Developer of land identified within this report; I agree to proceed, implement and comply with all recommendations and requirements outlined herein.

______________________________
Name of Developer

______________________________
Authorized Signature

THREE LAKES WATER AND SANITATION DISTRICT APPROVALS:

______________________________  __________________________
Signature                        Date
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  Calculated Water Demands: ................................................................. 1
  Proposed Water System: ................................................................. 2
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Wastewater System: ........................................................................ 4
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  Existing Wastewater System: .......................................................... 4
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Appendix A: Water Demands
Appendix B: Water Hydraulic Analysis and Modeling
Appendix C: Maps and Plans
  Vicinity Map
  WaterCAD Node Map
  Master Utility Plan
Project Location and Description:

Grand Lake Lodge is a 54.4-acre development (Site) located in the Town of Grand Lake. The Site is located in Sections 5 and 6, Township 3 North, Range 75 West and Sections 31 and 32, Township 4 North, Range 75 West of the Sixth P.M. The Site is bordered by the Rocky Mountain National Park on the east, north, and west, and to the east by residential lots along Mountain Ave and W Portal Road within the Town of Grand Lake. See Appendix E for the vicinity map.

In the current condition a portion of the site is un-developed and is primarily mountainous terrain. The topography of the site generally slopes at 10-25% and primarily north to south, and the westernmost portion of the site slopes to the west. There are no major drainage channels located within the site. Historically drainage across the site consists of sheet flow. Located on the western portion of the site is an abandoned sewage treatment pond. Our review of the USGS’s online soil survey suggests the on-site NRCS soil types consist of Class A soils. There is not a regulatory floodplain affecting the Site.

As shown on the Overall Site Plan, ownership proposes to construct 86 rental units in the form of cabins, a visitor’s center and living quarters for the lodge’s manager. Based on economic constraints, on-site infrastructure will be phased as the demand for rentals increase. Our overall plan has been developed with utilities being a key focus. It is assumed that all on-site water mains will be privately maintained by the Lodge. All on-site sanitary mains will be turned over to Three Lakes Water and Sanitation District utilizing their public main extension process. A 20-foot sanitary sewer easement will be granted to the District, while maintaining redundancy throughout the system. When located outside of dedicated rights of way, easements will be provided around water mains and sanitary sewer mains in accordance with Three Lakes Water and Sanitation District standards regarding location and size and will be dedicated at the time of construction documents submittal.

Water System:

Calculated Water Demands:

Average Daily Demand (ADD) for water distribution flows for the rental units were calculated based on the International Association of Plumbing and Mechanical Officials (IAPMO) – 2018 Uniform Plumbing Code demand rates listed in the table below. The ADD for water distribution for the Lodge was based upon past usage and assuming a 50% growth rate in 2018 and stationary growth in 2019.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Typical ADD/Unit</th>
<th>Modeled Flows at MDD/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental Units</td>
<td>333 gallons per day (assumes 2.7 persons per unit)</td>
<td>2.78 gallons per minute</td>
</tr>
<tr>
<td>Visitor Center</td>
<td>541 gallons per day¹</td>
<td>3.78 gallons per minute</td>
</tr>
<tr>
<td>Lodge</td>
<td>2403 gallons per day²</td>
<td>40 gallons per minute</td>
</tr>
</tbody>
</table>

¹ The managers residence will be combined with the Visitor’s Center, refer to Appendix A for additional details.
² Refer to Water Demand Calculation Spreadsheet in the Appendices
The Maximum Day Demand (MDD) was calculated by multiplying the ADD by the Max Day/Avg Day Flow Ratio of 3.00 for rental units and 3.00 for lodge. The Peak Hour Demand (PHD) was calculated by multiplying the MDD by the Max Hour/Max Day Flow Ratio of 1.9. See table in Appendix A for water system demands.

Fire flows for the overall develop were calculated at each proposed fire hydrant based on IFC code requirements. The Fire Flow Analysis was completed during the Maximum Daily Demand period with the tank elevation partially full to determine the available fire flows under poor conditions. Based on IFC, the required fire flows for the cabins are 1,500 gpm and 2,500 gpm for the lodge.

**Existing Water System:**

Under existing conditions, there is a water line located within the Old Tonahutu Ridge Road right-of-way. The existing waterline in Old Tonahutu Ridge Road extends to the east to the existing Grand Lake Lodge and south Patterson Street. Based on available records, all primary transmission mains on-site are 8-inch. There is a water storage tank located central to the site which is used by the Town of Grand Lake to build pressure throughout their system. The subject system is assumed to lie within the same pressure zone.

Elevations within the Grand Lake Lodge area varies from 8595 feet to 8735 feet after final buildout, which results in anticipated static water pressures of between 39 psi and 74 psi in the portion of the system modeled. Our model calculates the static pressures using the correlation between the known maximum/minimum ground elevations, hydraulic gradelines and pressures in the pressure zone and the known elevations at the site.

The Grand Lake Lodge property will draw their water supply from the water storage tank located on-site.

**Proposed Water System:**

As stated above, to analyze the existing and proposed system, our team developed a WaterCAD model of the system based on available records and then expanded upon that system in the proposed. Condition.

Our two primary objectives when designing the new distribution system were 1) sufficient fire flows and 2) water quality.

**Fire flow:** Given the height of the water storage tank and the static pressure available in the existing system, obtaining adequate fire flows for existing and proposed structures with finished floor elevations above elevation 8600 will be a challenge. To provide 1,500 gallons per minute of fire flow for the proposed cabins, new hydrants will be fed by 6-inch Ductile Iron Pipe (DIP) Class 52 piping. Hydrants have been limited to the extent feasible while providing a maximum coverage of 500 feet.

**Water Quality:** Given the use proposed for the cabins, it is reasonable to think that water quality will be an issue if using large mains. Our design incorporates 6-inch mains up to the required fire hydrants and then 2-inch mains thereafter. This should increase the turnover and mitigate extensive water losses necessary to maintain sufficient chlorine content is proposed throughout the new system.
Proposed Water System Analysis and Modeling:

WaterCAD was used to model the entire Grand Lake Lodge distribution network. The model was developed using the existing water storage tank as the primary water source delivering water and pressurizing the system. The primary analysis used to determine system capacity was a Fire Flow Analysis which analyzes the system during a period of Maximum Daily Domestic Demand (MDD) and a fire flow event occurring simultaneously. The maximum flow at each hydrant is then determined by maintaining 20 psi of residual pressure in the system. The following paragraph outlines the results of our model and the necessary system upgrades to support the development.

Initially, our model analyzed the available fire flow at nine (9) fire hydrants using the existing system in its current condition. Given the overall size of the Lodge, fire flow requirements will be greatest to cover that structure. Fire Hydrant H-1 is located immediately west of the Lodge and will provide fire coverage. Using the existing system, the available fire flow at Hydrant H-1 is 1,154 gpm. Given the commercial use, 2,500 gpm should be available. The new hydrants proposed to cover the Visitor’s Center and cabins will have a maximum available fire flow of 1,211 gpm which fails to meet the IFC’s 1,500 gpm minimum.

Determining that the existing system will not provide adequate fire flows throughout the development, our team developed improvements to the existing system that would improve the available fire flow. Our modeling determined that the primary upgrade needed to the system is to install an additional 12-inch main from the existing tank south to the lodge and continuing west to the intersection of the lodge access and Old Tonahutu Ridge Road. Once added, the available fire flow at Hydrant H-1 is 3,500 gpm. The minimum fire flow in the system expansion is 1,591 gpm at Hydrant H-5 which is the southeastern most hydrant in Phase IV of the Cabin Project, this hydrant is located at a dead-end line which will be used to flush the system when needed, these cabins can also be serviced by hydrant 6 which has a fire flow of 2,679 gpm.

Therefore, our team recommends that an additional main from the tank to Hydrant H-1 and into the existing system at the intersection of the lodge access and Old Tonahutu Ridge Road be installed with a 12-inch DIP Class 52 watermain to provide adequate fire flows throughout the existing and proposed system which meets current IFC and Town requirements.
Wastewater System:

Calculated Wastewater Flows:

Average Daily Flow (ADF) for wastewater flows were calculated based on the Three Lakes Water & Sanitation District flow rates obtained from the As-Built Plans for Tonahutu Ridge Road, these flow rates are listed in the table below:

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Typical ADD/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental Units</td>
<td>100 gpd/unit</td>
</tr>
<tr>
<td></td>
<td>(assumes 2.7 persons per unit)</td>
</tr>
</tbody>
</table>

Peak flows are determined by multiplying the Average Daily Flow (ADF) by the peaking factor (PF). The Peaking Factor (PF) is a function of:

\[ PF = 3.8 / [(ADF)^{0.17}] \]

ADF in millions of gallons per day; Max PF = 5.0

The application of this equation resulted in a PF of greater than 5.0, so the maximum value of 5.0 was used instead. The Peak Design Flow (PDF) is calculated by multiplying the ADF with its Peaking Factor.

\[ PDF = (ADF \times PF) \]

<table>
<thead>
<tr>
<th>DOMESTIC FLOW</th>
<th>FLOW MILLION GALLONS PER DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNITS</td>
<td>DESIGN FLOW</td>
</tr>
<tr>
<td></td>
<td>CAPITA PER UNIT</td>
</tr>
<tr>
<td>86</td>
<td>2.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MIN. SLOPE (%)</th>
<th>PIPE DIA. (IN)</th>
<th>PIPE MAT</th>
<th>n</th>
<th>CAPACITY OF PIPE</th>
<th>VEL. (FPS)</th>
<th>VEL. (FPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>8</td>
<td>PVC</td>
<td>.011</td>
<td>(MGD)</td>
<td>PEAK FLOW</td>
<td>FULL FLOW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(CFS)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Existing Wastewater System:

Under existing conditions, there is existing sanitary sewer infrastructure located within the site. The existing sanitary sewer consists of an 8" sanitary sewer line running generally from north to south through the Site, the line is located within the Old Tonahutu Ridge Road right-of-way.
Proposed Wastewater System:

The proposed sanitary sewer system consists of 8” PVC mains in addition to 4” laterals for each lot. The proposed system connects to the existing sanitary sewer pipes located just south of Old Tonahutu Ridge Road, the existing manhole at this location will need to be replaced as it only provides approximately 3-ft of cover and a portion of the existing sanitary sewer will be removed as part of the proposed improvements. The proposed sanitary sewer will continue to the south and connect to the existing 8” sanitary sewer line within Mountain Ave. The Overall Utility Plan can be found in Appendix E.

References:


Appendix A: Water Demands
# WATER DEMAND CALCULATION

**Designer:** Craig Rothkeubber  
**Company:** Bowman Consulting Group  
**Date:** 8/26/2018  
**Project:** 020379 - Grand Lake Lodge  
**Location:** Grand Lake, CO

## RENTAL UNITS

<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Consumption</th>
<th>Daily Uses</th>
<th>Duration</th>
<th>Occupants</th>
<th>ADD (gpd)</th>
<th>MDD (gpd)</th>
<th>MDD (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6 gpf toilet - (gallons per flush)</td>
<td>1.6</td>
<td>2.75</td>
<td>1</td>
<td>2.7</td>
<td>12</td>
<td>36</td>
<td>0.10</td>
</tr>
<tr>
<td>Kitchen Sink - 2.2 gpm</td>
<td>2.2</td>
<td>2.5</td>
<td>0.3</td>
<td>2.7</td>
<td>4</td>
<td>13</td>
<td>0.04</td>
</tr>
<tr>
<td>Bathtub/Shower Combination - 5.5 gpm</td>
<td>5.5</td>
<td>0.8</td>
<td>9</td>
<td>2.7</td>
<td>107</td>
<td>321</td>
<td>0.89</td>
</tr>
<tr>
<td>Bathroom Sink - 1.5 gpm</td>
<td>1.5</td>
<td>2.5</td>
<td>0.25</td>
<td>2.7</td>
<td>3</td>
<td>8</td>
<td>0.02</td>
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<tr>
<td>Dish Washing Machine - 1.3 gpm</td>
<td>1.3</td>
<td>0.25</td>
<td>75</td>
<td>2.7</td>
<td>66</td>
<td>197</td>
<td>0.55</td>
</tr>
<tr>
<td>Washing Machine - 3.5 gpm</td>
<td>3.5</td>
<td>0.2</td>
<td>75</td>
<td>2.7</td>
<td>142</td>
<td>425</td>
<td>1.18</td>
</tr>
<tr>
<td><strong>TDV:</strong></td>
<td><strong>333</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>1,000</strong></td>
<td></td>
<td><strong>2.78</strong></td>
</tr>
</tbody>
</table>

## GRAND LAKE LODGE

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
<th>Units</th>
<th>Duration</th>
<th>ADD (gpd)</th>
<th>MDD (gpd)</th>
<th>MDD (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>501,000</td>
<td>gal.</td>
<td>June-Aug</td>
<td>309</td>
<td>928</td>
<td>15</td>
</tr>
<tr>
<td>2017</td>
<td>865,000</td>
<td>gal.</td>
<td>June-Aug</td>
<td>534</td>
<td>1,602</td>
<td>27</td>
</tr>
<tr>
<td>2018</td>
<td>1,297,500</td>
<td>gal.</td>
<td>June-Aug</td>
<td>801</td>
<td>2,403</td>
<td>40</td>
</tr>
<tr>
<td>2019</td>
<td>1,297,500</td>
<td>gal.</td>
<td>June-Aug</td>
<td>801</td>
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Appendix B: Water Hydraulic Analysis and Modeling
## Grand Lake Lodge
### WaterCAD Results - Fire Flow Results

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### Grand Lake Lodge

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**Grand Lake Lodge**  
**Dead End Stub Water Quality Analysis**

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*Given that these units are rentals, the most conservative way to calculate turnover is to assume that only one unit will be rented at any given time and the average daily use will apply for that unit.*
Appendix C: Maps and Plans
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Overall Utility Plan:
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Updated Summer of 2018
1.0 PREFACE

The town of Grand Lake, the Lodge Ownership, and the community have a deep commitment to the preservation of the Lodge and its Rocky Mountain environment. Over the history of the Lodge and its surroundings, there have been plans to refurbish the existing lodge building, expand the lodging facilities and create a national park style village similar to those found in national parks such as Yellowstone and the Grand Tetons. The goal should be to develop the property in an architectural style compatible with the historic Grand Lake Lodge building.

The intent is to assure that all development within this special property respects the history of the Grand Lake Lodge and the natural environment of Rocky Mountain National Park, which is contiguous in beauty, setting and spirit.

2.0 GRAND LAKE LODGE ARCHITECTURAL STYLE

Nestled amongst the high mountain forests of the Rocky Mountains is the historic Town of Grand Lake. Rich in the history of Colorado, Grand Lake is a picturesque confluence of mountains, roaring streams and high-altitude lakes. Perched in regal splendor, a jewel of the Rockies, Grand Lake Lodge sits high above the majestic lakes and historic town. The Grand Lake Lodge property stretches along 71 acres of incomparable natural beauty and spectacular views. Adjacent to Rocky Mountain National Park, this association of private enclave and public lands creates a special environment.

In the late nineteenth and early twentieth centuries, America's most prominent families-built summer retreats that came to be known as the Great Camps of the Adirondacks. The camps reflected the serenity and indelible power of their surroundings and the rustic Adirondack style was born. This architectural style is founded in decorative rustic woodwork, heavy foundations or stone work, and use of natural materials. This rustic style has been adopted for hotels and private homes throughout the West, including those in the Town of Grand Lake. In 1916, the Adirondack architectural style was adopted by the National Park Service for
their lodges, thus making this regional style familiar to people across the country. The Ahwahnee in Yosemite, Old Faithful Inn in Yellowstone, Bryce Canyon Lodge, Lake McDonald Lodge in Glacier National Park and others have their architectural roots in the Adirondack style.

The Adirondack style is a harmony of the natural beauty of the environment, the logical combination of local craftsmanship traditions and readily available indigenous materials. It is architecture with a special, intrinsic approach to the natural surroundings. It was spawned from the picturesque natural beauty of wooded mountains and the vistas of mountain peaks. In an atmosphere of roaring brooks and high mountain lakes, it has emerged as a spectacular form of rustic, yet refined, architecture.

It is fitting that the Adirondack style found its way to the Grand Lake region. Amongst the great natural beauty of Grand Lake, from the deep, wooded forest to the "mirrors in the mountains", the picturesque lakes, the Adirondack style is represented in the Grand Lake Lodge, as well as many private homes built in this area in the late 1800s and early 1900s. Here, amongst the robust climate and roaring mountain streams that thread their way down to the high-altitude lakes, are jewels of the Adirondack style.

The Lodge, built in 1920, has distinct architectural relationships to the Great Camps of the Adirondacks. The hand peeled log trusses and columns, the fireplace of regional stone, the covered porch with articulated wood railings supported by peeled log columns, highlight the rustic, yet eloquent, design.

True to its history, a commitment of architectural compatibility will be preserved throughout the Grand Lake Lodge property. Each structure should embrace the rustic, connection to the Lodge, collectively forming an indigenous environment with the spectacular natural beauty of Grand Lake. It is important that each new building embrace this commitment of spirit, history and environment.
True to its history, a commitment of architectural compatibility will be preserved throughout the Grand Lake Lodge property. While it is important that each new building embrace this commitment of spirit, history and environment – it should be noted that new structures should not try and simply “copy” the Lodge architecture. The intent of new architecture should not dilute the uniqueness of the existing Lodge. This offers an opportunity for Modern interpretations of the Adirondack style that contain the elements listed in these design guides, but also embrace contemporary construction techniques.

3.0 PURPOSE AND OBJECTIVES

The purpose of these Design Guidelines is to maintain the design and architectural integrity of the Grand Lake Lodge development, assure that development conforms to these standards and that owners and their architects understand and appreciate the design character and environmental sensitivity required in their planning.

An owner planning to build at Grand Lake Lodge is responsible for obtaining, reviewing and adhering to all current governing regulations that apply to their proposed construction. With respect to the ordinances of the Town of Grand Lake, including their Design Review Standards, if there are differences between the town’s requirements and these Design Guidelines, the more restrictive requirement governs.

The Town of Grand Lake will be the reviewing body and staff or Planning Commission discretion will be required for future development. It is the hope that these bodies will use its best judgment to see that all improvements, construction, landscaping and alterations of the land conform to these guidelines and harmonize with the natural surroundings and existing structures.

The guidelines are not intended to unnecessarily restrict creative design or efficient construction. It is expected that the Design Guidelines will be amended from time to time, and reviewing bodies should consider variances, on a case by case basis.
4.0 CHARACTER
The spirit and character of the Great Adirondack Camps and Rocky Mountain National Park is the inspiration for the appearance of all roads, landscaping and buildings. All buildings and landscaping must be in harmony with the natural environment.

The Adirondack character is a vernacular style of architecture consisting of a mixture of logs, native stone and decorative railing work. Combined with large wood trusses and columns, fireplaces and chimneys of regional stone and covered porches with articulated wood railings. It is rustic, yet eloquent in composition, design and materials.

Each structure should embody the living history of this architectural style, collectively forming an indigenous environment with the spectacular natural beauty of Grand Lake. Buildings should be designed in a subtle fashion that harmonizes with the surrounding landscape and appear to recede into the landscape through meticulous use of natural materials in an appropriate scale, through use of forms and massing related to the surrounding topography and through careful site design.

5.0 MATERIALS
Using native materials contributes to the harmonious blend of function and character desired for the Grand Lake Lodge community. The Adirondack style typically used native stone or rock at the base, evoking a feeling of strength and mass. Upper floor levels were wood, e.g., log, half-log, peeled and unpeeled log, brainstorming or clapboard. Exterior finishes such as stucco and brick shall not be used.

Wood should be spruce, pine or cedar. Appropriate fabricated materials including ornamental uses of wrought iron, carbon steel and patina copper can be used to further capture the Rocky Mountain-Adirondack character. The key for maintaining a harmonious blend is continuity in the use of materials.

6.0 COLORS
The responsibility of owners and their designers is to respect the natural beauty and build to complement the natural environment. Muted, pale, subtle, neutral, and earthy colors are
abundant in the forest and natural landscape of the Grand Lake area and these subdued colors should be used in harmony with natural wood colors at all exterior applications. Typically, the Adirondack style of architecture used muted reds and greens at door and window trims to accent the natural wood siding.

7.0 SITING

Each building site and envelope represents a precious environment that, although it must be disturbed, should be protected. Environmental assets such as trees, boulders, natural topographic slopes and vegetation shall be regarded with care and protected during construction. These existing assets will embrace the new structures and help to form a natural blending with the environment. The location of structures should consider the following:

- Minimize disturbance to the site
- Protect special site features
- Orient the building to take advantage of views and solar access
- Take advantage of topography
- Consider neighboring homes and privacy

8.0 BUILDING MASS

Proper massing will create a feeling of homes and buildings as part of the land, topography and environment rather than dominating the landscape and departing from a synergistic relationship with the environment. The Adirondack style has an eloquent and ornamental theme that blends with its rustic nature.

Covered porches and balconies and articulated wood railings will add interest and break up wall massing. Combinations of facade treatments such as stone, rock, ornamental details, brackets and trim, will help break up large surfaces. Large massing of vertical and horizontal wall surfaces should be avoided.

9.0 SCALE

Buildings without texture or pattern lack scale. A structure in the natural environment
demands even more attention to scale so it does not impose on the natural beauty of the
land. Scale refers to the proportional relationship of humans to their built environment.
Challenges with scale can come when materials lack three-dimensional relief, elements are
not directly related to the size of a human, or there has been a lack of attention to small
details.

Appropriate textural treatments are effective in softening a visual statement and blending
a structure with its environment. Using materials such as stone, rock and wood creates
scale.

By recessing the windows within their framework and articulating structural elements
such as columns, posts and beams, interest and scale can be established. Small and
whimsical elements create intricacy, familiarity and architectural delight. A general
rule of thumb of the Adirondack style is that anything structural can be ornamental,
and should be expressed.

10.0 MANUFACTURED COMPONENTS
Component manufacturing, including panelized construction or pre-fabricated units, may
be appropriate due to the limited construction season. It is generally acknowledged that
this type of construction, which includes pre-assembled trusses and wall panels, can save
construction time.

11.0 OPEN SPACE
Open space is an asset to the development as a whole, and the environment of each
building site. Buffers between adjacent properties serve to help maintain a unifying,
natural landscape throughout the Grand Lake Lodge development. Open space areas shall
be left in a natural state.

12.0 BUILDING HEIGHT
The maximum building height is 35 feet. Height will be measured from a point at the
lowest finished or natural grade to the highest peak of the roof.
13.0 SOLAR DESIGN
Orientation, material choice and architectural elements should be explored for optimum passive solar efficiency. Passive collection principals such as thermal mass surfaces that function for collection and redistribution of heat should be incorporated. Solar collection at south facing view windows should also be considered in conjunction with roof overhangs. Careful consideration should be given to roof mounted active collection panels, to ensure compatibility with the architecture.

14.0 ROOFS
In keeping with the Adirondack style, roof pitches shall be a minimum of 2: 12 and a maximum of 12:12. Open gables have been typical of Adirondack style architecture, however many variations including hips and shed roof forms are found in the style. Adirondack style architecture typically utilized large overhangs to keep snow away from foundations and building walls. Dormers in roofs can add identifiable character and provide visual interest on larger roofs. Care should be given in selecting roof materials and colors; primary concerns are fire resistivity, and not detracting from natural setting. Bright or “loud” colors are not appropriate, including coated copper that does not weather or age to a dulled sheen. If exposed, gutters and downspouts are encouraged to be patina or aged copper, otherwise they should be concealed with eaves, structural columns, or trim.

15.0 WINDOWS
In the early Adirondack camps windows were small, glass was hard to come by and difficult to replace, and since it was not an insulator, these small windows were necessary for the long cold winters. Technological advances and a desire to bring the outside indoors, dictate justification for larger amounts of glazing, however care should be given to integration into overall architecture.

Windows should be vertically oriented, with a greater height to width ratio. Window spacing, mulled windows, wall articulation, and/or multiple panes and separating mullions provide a desirable effect and create depth and character in the structure.
White Vinyl clad windows are not permitted. Diamond and unconventional shaped windows crept into the vernacular of the Adirondack architecture and can add interest and character.

16.0 ENTRIES
In the Adirondack style, entries tend to be protected by a supported overhang or porch-like element. This protective element enhances the significance of the entry, consisting of the door and its surround, and invites the visitor to slow down and examine detail. An entry door provides the opportunity to make a Statement – through scale, material, fenestration, hardware, or all of the above.

17.0 FOUNDATIONS
Exposed foundations and structure were typical in the Adirondack style, and often expressed in stone. Exposed foundations give balance and add both integral interest and authenticity to the structure. Stone selection should be indigenous to the grand lake area, and if exposed concrete or masonry consider board formed texture or expressive block.

18.0 WALLS
The vernacular style of Adirondack architecture is largely identified by wall and siding material. Several different types of siding and wall construction are appropriate in keeping with this unique and eloquently rustic theme. They are another opportunity to provide scale and interest. Walls should be of substantial depth and character to balance the structure.

19.0 RETAINING WALLS
Retaining walls should be a natural extension of the land. Stone or boulder retaining walls are appropriate. Retaining walls above 6 feet in height, should be terraced where possible, to reduce any one rise to a 6 foot height. Planted areas should occur between terraced walls.
20.0 PORCHES, PATIOS, BALCONIES AND DECKS

Outdoor spaces are typical of the Adirondack style. Decks, porches, verandas and patios should be considered exterior rooms that take advantage of the outdoors. Decks should be thought of as porches and should, when possible, span entire facades. Deck are encouraged to be covered, and use timber, stone, or log columns.
Railings of wood or ornamental metal should be used on porches, verandas, decks and balconies.

21.0 PATHWAYS
Pathways should be designed and constructed with regard to their visual effects and impact on the environment. The path width, alignment and materials are important. The path should be as narrow as possible, winding to create interest and paved with materials that are consistent with the surroundings. Existing terrain, vegetation, rock outcroppings and other natural features should be preserved and incorporated into the design. Low-lying walls may be used to define gateways. Decorative features, if used, should derive their appearance from the architecture and landscape design.

22.0 FENCES
Fences are discouraged, and should not be utilized for privacy or delineation – however they may be require for certain functions.

23.0 SCREENING
Screening is important in the collective environment of this community. Utilities, venting, and other non-aesthetic elements necessary to the function of a building should be screened in a sensitive and contiguous way. Awareness of each owner's adjacent property views will provide reciprocal benefits in this environmentally sensitive area.

24.0 OUTDOOR ELEMENTS
Exterior features such as hot tubs and bar-b-cues are allowed if incorporated within the deck, porch, patio, or balcony areas. Such elements help to connect the user to the natural setting, however care should be given to fire protection.
25.0 LIGHTING
Historically, walkway lighting was provided by glass enclosed kerosene lanterns throughout the Great Camps. Today, pathways are best lit by lantern-type lights on low posts that illuminate roots and rocks and create an obvious trail.

Lighting, appropriately designed, adds finishing touches to successful architectural and landscape design while emphasizing the environment and rustic ambiance. Indirect sources and horizontal cutoff fixtures can reduce glare and provide ambient lighting. Subtle applications and soft lighting can enhance pathways and landscaping.

Up lighting of trees is prohibited. This type of lighting creates an unnatural and imposing atmosphere. Lighting, where the direct source is visible from a neighboring property or which produces excessive glare, is not permitted.

26.0 PETS AND WILDLIFE
Native wildlife are abundant and a marvel to see and enjoy. They can also be a real and present danger. Any attempt to artificially attract wildlife is prohibited, including leaving trash containers outdoors. Pets of any size have little chance of surviving an encounter with bears, mountain lions, coyotes and other predators. Pets shall be protected and prohibited from interfering with wildlife.

27.0 WILDFIRE MANAGEMENT
Wildfire management is the responsibility of all within the Lodge site. Building materials should be carefully selected for fire-resistivity and Wildland Urban Interface. In addition gutters should be seasonally cleaned and spark arresters and screens must be used at all wood burning chimneys.

28.0 ROCKY MOUNTAIN NATIONAL PARK
Rocky Mountain National Park is our immediate and respected neighbor. Social trails and un-restricted entrance to and from the park should be discouraged. A buffer should be maintained between the Park and the Lodge.
29.0 PRESERVATION PRINCIPLES
The property of Grand Lake Lodge is part of the Grand Lake Lodge Historic District. The Lodge should work Collaboratively with Nation Park Staff, Town Staff, and the State Historic Preservation Office. While Lodge is part of the Historic District, the Secretary of the Interior makes it clear that “New additions ... or new construction shall not destroy the historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale and architectural features to protect the historic integrity of the property and it’s environment”.

LANDSCAPE GUIDELINES
The Grand Lake Lodge community lies within a fragile mountain environment populated by rich and diverse native plants and wildlife. The land is punctuated by native stone outcroppings, mature aspen groves, conifer stands and carpets of meadow grass and wildflowers. The land offers unparalleled views of surrounding mountains, lakes and valleys. The goal is to blend buildings and grounds into this spectacular setting.

Landscaping should reflect the character of Rocky Mountain National Park. Landscaping and re-vegetation of the property should blend with the existing environment and natural lay of the land. The use of native trees, shrubs and groundcovers, along with boulders, will help duplicate what nature might have done. Natural features such as rock outcroppings, large, unique specimen trees, natural drainage, and other elements that have a high aesthetic value shall be preserved.

Well-chosen landscape materials include native trees, shrubs and grasses that grow naturally and are locally available. Due to the relatively short growing season, large caliber deciduous trees and mature evergreens are recommended.

Some building sites will require minimal landscaping and re-vegetation while others will require screening to buffer visual impacts from adjoining properties. Highly exposed
building sites will require a significant amount of landscape screening to buffer the views from the Town.

All disturbed soil areas created by site grading or building construction shall be re-vegetated. All existing trees and shrubs, rock outcroppings, and any other significant features on or near the site shall be protected throughout the construction process. Trees within the construction area that are to be saved shall be fenced at the drip line, the branches and roots protected and the trunk wrapped with lattice to avoid damage to the bark layer.

LANDSCAPE PLAN
   Refer to town municipal code for landscape plan requirements
   A description of how the proposed plant materials are to be watered and maintained until they are established and can survive on their own with natural precipitation.

IRRIGATION AND MAINTENANCE
   Water is a scarce and precious resource in the mountains. Watering and irrigation should be done judiciously.
   All new trees and shrubs should be watered and maintained until they have become established and can survive on their own with natural precipitation.

CONSTRUCTION RULES AND REGULATIONS
   Construction management is an important part of any development at Grand Lake Lodge. The goal is to minimize disturbance and noise, retain as large amount of undisturbed area possible and protect adjacent properties.

Existing Vegetation and Erosion Control
   Methods for protecting existing vegetation, particularly vegetation within the limits of construction, shall be indicated on the Plan. Erosion and sedimentation control measures shall be incorporated in accordance with Town regulations. All protective measures shall be implemented prior to initiating construction.
Temporary Sanitary Facilities
Job sites shall be equipped with sanitary facilities. Such facilities shall be screened from view from adjacent properties and roadways. All temporary structures shall be removed after the occupancy permit is issued.

Permits
The owner or contractor is responsible for obtaining all required permits.

Debris and Trash Removal
Contractors shall clean up all trash and debris on the construction site at the end of each day. Trash and debris shall be removed from the site at least once a week to a dumping site located outside the Grand Lake Lodge area. Lightweight material, packing and other items shall be covered or weighted down to prevent wind from blowing such materials off the construction site.

Utilities
Utilities should be designed and constructed for the most intensive use that can reasonably be foreseen. All utilities should be designed and installed according to applicable town, county and district regulations. Accurate as-built drawings shall be prepared by the Contractor to tie the location of all underground utilities to permanent reference points. Copies shall be submitted to the governing utility or regulatory agencies upon completion of the construction review process.
PLANNED DEVELOPMENT PLAN, FIRST AMENDMENT
FOR
GRAND LAKE LODGE
LOCATED IN SECTIONS 5 AND 6, TOWNSHIP 3 NORTH, RANGE 75 WEST,
AND SECTIONS 31 AND 32, TOWNSHIP 4 NORTH, RANGE 75 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF GRAND LAKE, COUNTY OF GRAND, STATE OF COLORADO
Dear Town of Grand Lake Lodge,

We are aiming to revise the cabin designs for Grand Lake Lodge in an effort to best meet the feedback we received from the public workshop we held on June, 27th 2018 and the Planning commission meeting on June 6th. While many like the site plan, we understand that the A-Frame look was not a building type that is currently found in the context of Grand Lake. We are exploring the revised design to embody either a traditional site-built cabin, or a modular-prefabricated cabin. Either way, we are writing to inform you that through this revision of the cabins, and an update to the design guidelines, it is our aim to answer this feedback while celebrating the following key elements and characteristics as stated in the Design Guidelines for Grand Lake Lodge.

There must be a balance between architectural style, historic preservation, and modern construction techniques. We believe as if the A-Frame does a great job of being light on the land, and embracing the spirit of the great American Camps. We would like to continue to explore the architectural massing and detailing that is consistent with both the State Historic Preservation Office, the context of Grand Lake, and most importantly the great Lodge itself. While we believe it would dilute the significance of the Lodge to copy its architectural approach, it would also not be appropriate to apply such an overstated style to a small structure like a cabin. Therefore it is our believe that updating the design guidelines to embody the Adirondack style, but allow for an modern interpretation of that architecture is the best approach.

In review of the Existing Design guidelines, the below excerpts really highlight how we think this can be done.

Character: "Buildings should be designed in a subtle fashion that harmonizes with the surrounding landscape and appear to recede into the landscape through meticulous use of natural materials in an appropriate scale, through use of forms and massing related to the surrounding topography through careful site design". The cabins, design will incorporate, native stone, covered porches with articulated wood railings with an aim to embody the guidelines goal of being "rustic, yet eloquent in composition, design and materials."

Materials: Native Stone/Rock Base and Anchors, Wood Upper Floors, Clapboard (Lap) Siding

Colors: Colors that blend with the abundant muted, pale, earthy in the forest and natural landscape.

Siting: "Environmental assets such as trees, boulders, natural topographic slopes and vegetation shall be regarded with care and protected during construction... Minimize disturbance to site, orient the building to take advantage of views and solar access, take advantage of topography..."

Building Mass: "Dispersion of mass throughout a structure can be accomplished by... multiple rooflines, varying in pitch and slope, as well as the utilization of dormers and gable ends... a stepping back of roof and wall facades will give depth and interest to the structures and mitigate overwhelming mass."

Scale: "Small and whimsical elements create intricacy, familiarity and architectural delight. A general rule of thumb of the Adirondack style is that anything structural can be ornamental."

Manufactured Components: "Component manufacturing, including panelized construction, may be allowed upon review and approval by the Committee. It is generally acknowledged that this type of construction, which includes pre-assembled trusses and wall panels, can save construction time."

Building Height: 35'

Roofs: "Large Overhangs, Open Gables with planked soffits"

Windows "Windows should be vertically oriented. Generally 2 1/2 times in height to width represents a vertical and rectangular configuration appropriate to the Adirondack style. Multiple panes and separating mullions provide a desirable effect and create depth and character in the structure. All window surfaces should be recessed from the facade of the structure to create shadowing and interest."
Entries: "In the Adirondack style, entries tend to be protected by a supported overhang or porch-like element. This protective element enhances the significance of the entry, consisting of the door and its surround, and invites the visitor to slow down and examine detail. Beam and log work at the entry covering is encouraged. Two story entries are prohibited."

Foundations: "Exposed stone foundations give balance and add both integral interest and authenticity to the structure. . . Stone, along with providing a solid visual base for the structure, accommodates steps in building foundations on sloping sites and provides the opportunity to extend the architecture into the landscape through the use of stone retaining walls.

Walls: "Several different types of siding and wall construction are appropriate...walls should be of substantial depth and character to balance the structure."

Porches, Patios, Balconies and Decks: "Decks, porches, verandas and patios should be considered exterior rooms that take advantage of the outdoors. Decks should be thought of as porches and should be built to wrap around a portion of the house. They should span entire facades, broken only by columns of indigenous material and should be covered and posted with columns of log, timber or stone. Railings of log, twig or ornamental metal should be used at all porches, verandas, decks and balconies regardless of elevation above grade. Deck surfaces should be either wood or stone.

In Addition to Architectural Style, we continue to hear thoughts and Ideas from the great Community of Grand Lake. Some other ideas mentioned include:

- Continue to work with the Nation Park Service to be a good neighbor, and look for ways to collaborate with design and operations.
- Ensure Dark Sky requirements for lighting of site and buildings.
- Continue to work with outside vendors and the Town to find ways to activate the winter season.
- Explore a shuttle or "town connection" for busy summer season, and slower winter season. In the summer, it could reduce the parking challenges of Town, while helping to connect the Lodge in the winter to the businesses that are open.
- Consider fire concerns with site planning and construction of new structures.
- Mitigation measures should be taken to reduce construction and activity noise.
- Tree preservation should be a continued goal of the Lodge Property.

It is the intent of the application to address these concerns in a physical layout, however continued engagement with the NPS and Town will be essential as many of these items are operational and not spacial. It has been a great experience to be a partner with the town and community to help shape and mold how this project moves forward.
November 5, 2018

Christopher Perdue
Bowman Consulting Group, LTD.
603 park Point Drive, Ste 100
Golden, CO  80401

**SENT VIA E-MAIL**

RE:  Referral Agency Comments for Third Review of Grand Lake Lodge PD Amendment and Site Plan

Dear Mr. Perdue,

On October 15, 2018, the above-mentioned application and supplemental materials was sent to the following referral agencies for review and comments.

The following agencies have been provided the application for review, but has not returned any comments:

- Town of Grand Lake Marina
- Xcel Energy
- Comcast
- Century Link
- Grand County 911
- Grand County GIS
- Grand County Assessor
- Grand County Road & Bridge
- Grand County Sheriff’s Office
- Grand County Planning Department
- CDOT Region 3
- Headwaters Trails Alliance
- Three Lakes Water and Sanitation District
- Grand Lake Metropolitan Recreation District
- Town of Grand Lake Town Attorney
- Mountain Parks Electric, Inc.
- Grand Lake Fire Protection District
- Town of Grand Lake Public Works Department
- Colorado
- Rocky Mountain - Hi

The following agencies have provided comments related to the application which must be adequately addressed by the applicant and/or owner:

- **Colorado Headwaters Land Trust**: Jeremy Krones, Program Director, 970-887-1177
  - See attached comments.

- **RG & Associates**: TJ D'ubac: 970-744-0623 and Gary Welp: 303-901-2447
  - See attached comments.

- **Rocky Mountain National Park**: Daria Sidles, RMNP Superintendent; Daria.Sidles@nps.gov
  - See attached comments.
Please review the comments included in this letter. If you have specific questions about an agencies comments, please contact the reviewer directly.

Make appropriate and necessary changes and re-submit the PD Amendment and Site Plan packages for review by 5pm Wednesday, November 14th.

If you have any questions, please contact me at 970-744-0623 or at TJDLubac@rgengineers.com,

Sincerely,

RG AND ASSOCIATES, LLC

TJ DLubac, AICP
Sr. Planning Manager

Encl:  Colorado Headwaters Land Trust
       Rocky Mountain National Park
       RGA Review Comments

Cc:    Francis Corso, Red Tail Acquisition
       Nathaniel Shull, Grand Lake Town Planner
BY EMAIL ATTACHMENT

Mr. Nathaniel Shull
C/O Town of Grand Lake
PO Box 99
Grand Lake, CO 80447

Re: Grand Lake Lodge Land Use Application – 3rd Submission

30 Oct 2018

Dear Mr. Shull,

Colorado Headwaters Land Trust (CHLT) has reviewed Grand Lake Lodge’s third submission in support of its PD Amendment and Site Plan, and makes the following comments in response to your request for comments of October 15, 2018. As you know, Colorado Headwaters Land Trust holds an approximately 14-acre conservation easement (the “easement”), placed on the property in 2001 by prior owners.

The drawings on page 92 of the Phase III Drainage Report indicate a drainage system (Pond A Emergency Spillway) to be constructed on the northern edge of the easement. Such construction and drainage are not allowed per subsections D (STREAMBANK AND OTHER TOPOGRAPHICAL CHANGES) and M (DRAINAGE) of section 5 of the Deed of Conservation Easement.

Additionally, while we did eventually receive Grand Lake Lodge’s response to our July comments on a previous submission, they were never sent directly to us. Instead, they arrived only as part of the materials liked to your October 15, 2018, email. As CHLT holds the easement on Grand Lake Lodge’s land, we would greatly appreciate a more direct and open line of communication with it and its representatives.

We look forward to resolving these issues in a collaborative and timely manner.

Sincerely,

Jeremy D. Krones
Program Director
Mr. Nate Shull, Town Planner
Town of Grand Lake
P.O. Box 99
Grand Lake, CO 80447

Dear Mr. Shull:

Thank you for the continued correspondence on the proposed amendment to the Planned Development Plan (PDP) for Grand Lake Lodge. As we understand the referral timeline, our previous letter, dated August 24, commented on the second submission. At the planning commission meeting on September 5, the commissioners and those present, including our staff, were commenting upon the second submission. After the September 5 meeting, the developer and Town wanted to address several points raised at the public meeting, including the Memorandum of Agreement of 1959. We provided correspondence on this matter via letter and email on September 20, 2018.

The applicant’s third submission included a response letter to the National Park Service dated August 30. We received this letter along with additional third submission documents in October. This letter is in response to your referral notice dated October 15, 2018 for the third submission by the applicant.

In the third submission, the developer has acknowledged our concerns but has made only a few changes to the development plan. Therefore, we refer you to our August 24 letter for our list of ongoing concerns, including fire hazards, setback from the park boundary, and traffic safety. We do appreciate receiving the landscape plan as part of the third submission, including a revised list of native species based our recommendations. Thank you for helping us protect the park’s native species.

Under cultural and historic resources section of the August 30 letter, the developer’s response included the following: “should our scope of disturbance ultimately be required within the Park.” We are not sure what this phrase means and seek clarification from the developer on what activities would require a scope of disturbance within the park.

Regarding traffic concerns, we received the revised traffic study by Bowman Consulting (dated August 30, 2018) on September 24. It concluded that turn lanes are not warranted. Sight distances and protected turn lanes are safety concerns as well as level of service issues. Further analysis and discussion is needed before this issue can be resolved.

We look forward to upcoming discussions with the Town and the developer,

Sincerely,

Darla Sidles
Superintendent
November 5, 2018

Christopher Perdue
Bowman Consulting Group, LTD,
603 Park Point Drive, Suite 100
Golden, CO 80401

RE: Planned Development Plan Review #3
Grand Lake Lodge
RGA Job No.: 1119.0003

Dear Mr. Perdue:

On August 31, 2018 RG and Associates, LLC received the following items for the Planned Development Plan (PD) request:

- Site Plan Comment Response Plans, undated
- Planned Development Plan Comment Response Plans, undated
- Design Guidelines, dated Summer of 2018
- Amended Drainage Report, dated August 30, 2018
- Updated Traffic Analysis, dated August 30, 2018
- National Park Service Comment Response Letter, dated August 30, 2018
- Colorado Headwaters Land Trust Comment Response Letter, dated August 30, 2018
- RG and Associates, LLC Comment Response Letter, dated August 30, 2018
- Utility Report, revision dated August 30, 2018
- Site Plan, revision dated August 31, 2018
- Planned Development Plan, revision dated August 31, 2018

Please review the comments below. If you disagree with a comment, check the "No" box and indicate the reason for your disagreement. All comments must have a response. Please contact TJ Dlubac at tjdlubac@rgengineers to obtain an electronic version of this letter in Word format to better facilitate your response.

GENERAL COMMENTS

Planning Comments
1. All planning review comments are provided as redlines identified on the applicable
document attached to this letter.

Complied: □ Yes □ No
Response: ____________________________

2. The parking standards identified within the Parking Count table on Sheet 1 of the Site
Plan differ from those identified on Sheet’s 1 and 2 of the PDP. Please amend as
necessary so all requirements are consistent.

Complied: □ Yes □ No
Response: ____________________________

PHASE III DRAINAGE REPORT

Engineering Comments

3. Appendix B: The storm pipe system for B4-1 and B4-2 should be model with stormCAD
as a culvert analysis may not be applicable due the 90-degree bend.

Complied: □ Yes □ No
Response: ____________________________

4. Appendix B: The riprap calculations for Culvert A1 has the incorrect flow rate.

Complied: □ Yes □ No
Response: ____________________________

5. Appendix B: The riprap calculations for Culvert A12 is mislabeled and should be Culvert
B3.

Complied: □ Yes □ No
Response: ____________________________
6. Drainage Maps: Please add flow arrows along the concrete pans for clarity.

Complied: [ ] Yes [ ] No
Response: 

7. Drainage Maps: Show the riprap pads on the plans.

Complied: [ ] Yes [ ] No
Response: 

8. Drainage Maps: Sub-basin B6 end with concentrated flow across the roadway. This should be convey with a culvert or crosspan to the opposite side of the road.

Complied: [ ] Yes [ ] No
Response: 

9. Drainage Maps: Erosion protection (i.e. riprap pads) may be needed where the concrete pans terminate at a earthen swale to prevent erosion.

Complied: [ ] Yes [ ] No
Response: 

10. Drainage Maps: Add revision dates to the plans.

Complied: [ ] Yes [ ] No
Response: 

**PLANNED DEVELOPMENT PLAN**

**Planning Comments**

**General Comments**

11. Please see redlines on the enclosed PDP and make all necessary changes.
12. Consider removing “Employee Housing” as a use within “Employee Lodge” Development Area, the note #3 associated with employee housing, and amend Development Standard #13 to include note #3 of the Zoning Standards table. This appears to address a number of the questions raised related to employee housing on this project and that the particular development area identified for such use doesn’t specify employee housing locations. If this use is removed, consider amending the name of the Development Area to better reflect the allowed/intended uses.

Complied: □ Yes □ No
Response: ________________________________________

13. Amend Development Standard #23 to reference the roadway treatment methods depicted on Sheet 2 of the PDP. Essentially, the paved roadway requirement (12-2-25(G)(c) can be granted by approving the PDP.

Complied: □ Yes □ No
Response: ________________________________________

14. Add a new Development Standard requiring a minimum of 20’ between buildings. The term “building” should be used rather than “construction” to be consistent with the established definitions of the Grand Lake Municipal Code.

Complied: □ Yes □ No
Response: ________________________________________

15. Add a new Development Standard stating that the project will utilize dark sky friendly lighting through the project.

Complied: □ Yes □ No
Response:  

16. Add a new Development Standard stating that adequate signage and/or fencing shall be installed throughout the property to limit, to the extent practicable, access from the property into Rocky Mountain National Park. All access should be directed to established trailheads and trail corridors.

Complied:  
Response:  

☐ Yes  ☐ No  

Sheet 2 – Planned Development Plan

17. Please verify the referenced reception number identifying the document to refer to for applicable standards for James Family Parcel and Tonahutu Ridge. Reception number 2001-013104 is referenced, but 2001-013102 may be the correct document.

Complied:  
Response:  

☐ Yes  ☐ No  

SITE PLAN

Planning Comments

General Comments

18. Delineate all wetlands on the property. If no wetlands exist, provide what measures were taken to determine that such areas do not exist.

Complied:  
Response:  

☐ Yes  ☐ No  

Sheet 1 - Cover

19. Add a sheet number for the Conceptual Landscape Plan within the Sheet Index Table.
Complied: □ Yes □ No
Response: ______________________________________

20. Align the project site within the Vicinity Map to accurately depict the project location.
Complied: □ Yes □ No
Response: ______________________________________

21. Development Area Lot Coverage calculations shall be provided to the Town prior to issuing the first building permit or approving construction documents for each Development Area.
Complied: □ Yes □ No
Response: ______________________________________

Sheet 2 – Overall Site Plan

22. While the Lodge Trail is depicted on the southwest portion of the property, there has been extensive discussions about additional trails (formal and social) throughout the property. Please generally delineate where these trails are and whether or not public access to each trail is anticipated to be allowed over the project property. If public access is granted, appropriate easements will be required to be recorded with the Grand County Clerk and Recorder.
Complied: □ Yes □ No
Response: ______________________________________

23. The Typical Roadway Section diagrams depicted on Sheet’s 2 and 3 of the site plan are inconsistent. Please amend so they are consistent.
Complied: □ Yes □ No
Response: ______________________________________
24. Amend the paving type legend for existing asphalt road to reflect what is showing on the Site Plan.

Complied: ☐ Yes ☐ No
Response: ________________________

Sheet 3 – Site Plan

25. This sheet is getting very crowded and difficult to read and understand all information shown. Consider separating some of the items into another sheet to more clearly understand the specific site layout and features. For example, can the Phasing lines and utilities be removed from this sheet since they are depicted on Sheet 4?

Complied: ☐ Yes ☐ No
Response: ________________________

Engineering Comments

26. See attached redlines.

FOR YOUR INFORMATION

The following comments are for your information and relate to future approvals, standards, or regulations necessary for the development actions requested. No action is necessary at this time on these items.

27. There were water improvements required to be extended throughout the property to service all proposed development. Such improvements shall not commence until appropriate construction documents, cost estimates, and sureties are submitted, reviewed, and approved by the town.

Complied: ☐ Yes ☐ No
Response: ________________________

28. The Site Plan was reviewed with the understanding that as each phase, as identified on the Site Plan, is built, Construction Documents, as required by Sec. 9-1-1(85), will be submitted
to the Town for review and approval prior to any work commencing on the property within that given phase and will need to consist of the following:

a. Cover sheet
b. General and specific notes sheet(s)
c. Survey control sheets
d. Roadway section(s) sheet with pavement/roadway section design
e. Roadway Plan and Profile Sheets
f. Sanitary Sewer Plan and Profile Sheets
g. Storm Sewer Plan and Profile Sheets
h. Water Layout Sheets
i. Detailed Grading Plans with contours and spot elevation
j. Detention pond grading and detail sheets
k. Detail sheets for roadway, parking, striping, signs, utilities, etc.
l. Erosion control plans
m. Erosion control details

Complied: □ Yes □ No
Response: ____________________________________________________________

29. There are areas were the maximum slope exceeds 3:1. A stability report or analysis may be required in conjunction with Construction Documents for areas steeper than 3:1 (in some cases up to 1.5:1).

Complied: □ Yes □ No
Response: ____________________________________________________________

Comments contained in this letter and attached as redlines, if any, are based on the documents submitted to date. Please contact TJ Dlubac at 970-744-0623 with any questions.

Sincerely,

RG AND ASSOCIATES, LLC

TJ Dlubac, AICP

Gary E. Welp, P.E., CFM
Senior Planning Manager

Senior Project Manager

Cc: Nate Shull, Grand Lake Town Planner
November 29, 2018

RG and Associates, LLC
Attn: TJ Dlubac & Gary Welp
561 Blue River Parkway, Suite 1A
PO Box 862

Re: 020379-01-001 Grand Lake Lodge – Comment Response No. 3
RGA Job No.: 1119.0003:01

To Mr. Dlubac & Mr. Welp

The following are our responses to your follow up comments provided via email on November 20, 2018 on the subject referenced project:

1. Confirm with GLFPD that gravel roadways are acceptable for secondary emergency access.
   
   Response: Our team is in contact with the Grand Lake Fire Protection District and will provide a formal response via email as soon as a response is received. Given their original comments dating back to May 3rd stated “we are hopeful that the emergency egress road through Woodpecker Hill area will be maintained, or better, improved”, our team feels as though the graveled surface which complies with the Headwater’s Land Trust requirement for the easement is adequate. It’s worth noting that none of the roadway’s immediately south of the Woodpecker Hill access are paved and therefore an asphalt surfaced access seems unnecessary. Mike Long (Fire Chief) has recently retired as the fire chief and that position has not been filled which has delayed a formal response on the issue.

2. Relocate interim grading note added within Phase III to Sheet 5 Master Grading Plan referencing the Phase 1 SWM Pond B.
   
   Response: The note has been relocated to Sheet 5.

3. Relocate interim grading note added within Phase IV to Sheet 5 Master Grading Plan referencing the Phase 1 SWM Pond A.
   
   Response: The note has been relocated to Sheet 5.

4. Utility Report indicated abandoned treatment pond on "west side of site". Appears the new mainline begins north and west of the main roundabout headed towards Tonahutu Ridge portion of the property. Where is the abandoned treatment pond that is referenced in the Utility Report? (repeat)
   
   Response: Note that the review comment referenced west side of the site; however, the comment is noted on the east side of the site. The abandoned sludge pond was located what is now the delineated wetland area on the western portion of the site (within Phase IV).
5. Label of slope south of and adjacent to secondary emergency access roadway is unreadable. Please edit to make slope legible.

*Response: The phase boundary has been adjusted so that the slope label is now legible.*

6. Remove references and notes associated with Footnotes 3 & 5 from the Zoning Standards Table.

*Response: These notes have been removed from the Zoning Standards Table.*

7. Add "Employee Housing" as an allowed use within the Existing Lodge Development Area within the Zoning Standards Table.

*Response: Employee Housing has been added as an allowable use within the Existing Lodge.*

8. Revise Development Standard #13 to read: "The Lodge shall provide on-site housing for a minimum of seventy-five percent (75%) of its employees. Employee Housing shall be measured by the number of beds provided. As of July 15, 2018, the Lodge provides 85 beds on-site and employs a maximum of XXX employees. Upon request, the Lodge will provide adequate information and access to the Town to confirm that this standard is being met."

*Response: Development Standard #13 has been updated.*

9. Add a new Development Standard stating: "All designated wetlands shall be appropriately mitigated as required by applicable Grand Lake Municipal Code and other state and federal regulations. Such mitigation shall be approved by the Town prior to issuance of construction permits for improvements on such designated wetlands."

*Response: Added as Development Standard #30.*

10. Remove the Parking Count table since parking standards are addressed in Zoning Standards Table on Sheet 1.

*Response: Removed.*

I trust these responses are sufficient to address staff’s concerns. Should you have any additional questions/concerns or require additional information, please feel free to contact

Sincerely,

Bowman Consulting Group, Ltd.

Christopher L. Perdue, P.E., M.B.A.
Engineering Team Leader
November 29, 2018

RG and Associates, LLC
Attn: TJ Dlubac & Gary Welp
561 Blue River Parkway, Suite 1A
PO Box 862

Re: 020379-01-001 Grand Lake Lodge – Comment Response No. 3
RGA Job No.: 1119.0003:01

To Mr. Dlubac & Mr. Welp,

The following are our responses to your comments dated November 5, 2018 regarding the above referenced project:

RG AND ASSOCIATES
General Comments

Planning Comments

1. All planning review comments are provided as redlines identified on the applicable document attached to this letter.

   Response: Redlines have been addressed on their respective sheets (see attached).

2. The parking standards identified within the Parking Count table on Sheet 1 of the Site Plan differ from those identified on Sheet’s 1 and 2 of the PDP. Please amend as necessary so all requirements are consistent.

   Response: Parking Count tables have been amended. The table on Sheet 1 of the PD identifies the Town Code Section where the parking requirements were taken from. The Cover Sheet of the Site Plan has been updated to reflect parking required by the current Town Code and parking provided. Note that the Table of Sheet 2 of the PD has been removed at RG’s request.

Phase III Drainage Report

Engineering Comments

3. Appendix B: The storm pipe system for B4-1 and B4-2 should be model with StormCAD as a culvert analysis may not be applicable due the 90-degree bend.

   Response: Storm pipes B4 (to Pond B) and A13 (to Pond A) have been modeled in StormCAD with the necessary tailwater and loss conditions in order to better represent the hydraulics going into the pond. These profiles are reflected in the Drainage Report.

4. Appendix B: The riprap calculations for Culvert A1 has the incorrect flow rate.

   Response: The riprap calculation for Culvert A1 has been updated with the correct flowrate and is reflected in the Drainage Report.
5. Appendix B: The riprap calculations for Culvert A12 is mislabeled and should be Culvert B3.
   
   Response: The riprap calculation has been updated to reflect the correct Culvert, B2, and is reflected in the Drainage Report.

6. Drainage Maps: Please add flow arrows along the concrete pans for clarity.
   
   Response: Additional arrows have been added to the Drainage Map to improve clarity of the direction of concrete pan flows.

7. Drainage Maps: Show the riprap pads on the plans.
   
   Response: Riprap aprons have been added.

8. Drainage Maps: Sub-basin B6 end with concentrated flow across the roadway. This should be conveyed with a culvert or cross pan to the opposite side of the road.
   
   Response: Cross pan added to convey water across road. Note that we will evaluate the final dimensions and cross-pan versus culvert during the development of Construction Drawings for Phase IV. Due to the super-elevation of the street section, the full 6.1 cfs generated by Basin B6 during the minor/major event is not anticipated to route through the cross pan.

9. Drainage Maps: Erosion protection (i.e. riprap pads) may be needed where the concrete pans terminate at an earthen swale to prevent erosion.
   
   Response: Riprap pads have been added at two locations where concrete pans terminate to an earthen swale (see drainage map). Calculations for sizing have been added to the Drainage Report.

10. Drainage Maps: Add revision dates to the plans.
    
    Response: Revision dates added.

Planned Development Plan

Planning Comments

General Comments

11. Please see redlines on the enclosed PDF and make all necessary changes.
   
   Response: Redlines have been addressed on their respective sheets (see attached).

Sheet 1 – Cover

12. Consider removing "Employee Housing" as a use within "Employee Lodge" Development Area, the note #3 associated with employee housing, and amend Development Standard #13 to include note #3 of the Zoning Standards table. This appears to address a number of the questions raised related to employee housing on this project and that the particular development area identified for such use doesn’t specify employee housing locations. If this use is removed, consider amending the name of the Development Area to better reflect the allowed/intended uses.
Response: This comment has been superseded by Comments 6, 7 and 8 on the attached comment response letter dated November 29, 2018.

13. Amend Development Standard #23 to reference the roadway treatment methods depicted on Sheet 2 of the PDP. Essentially, the paved roadway requirement ((12-2-25(G)4(c) can be granted by approving the PDP.

Response: Development Standard #23 has been amended to reference Sheet 2 of PD for final surface treatments.

14. Add a new Development Standard requiring a minimum of 20’ between buildings. The term "building" should be used rather than "construction" to be consistent with the established definitions of the Grand Lake Municipal Code.

Response: Added as Standard 27.

15. Add a new Development Standard stating that the project will utilize dark skyfriendly lighting through the project.

Response: Added as Standard 28.

16. Add a new Development Standard stating that adequate signage and/or fencing shall be installed throughout the property to limit, to the extent practicable, access from the property into Rocky Mountain National Park. All access should be directed to established trailheads and trail corridors.

Response: Added as Standard 29.

Sheet 2 – Planned Development Plan

17. Please verify the referenced reception number identifying the document to refer to for applicable standards for James Family Parcel and Tonahutu Ridge. Reception number 2001-013104 is referenced, but 2001013102 may be the correct document.

Response: Amended.

Site Plan
Planning Comments

General Comments

18. Delineate all wetlands on the property. If no wetlands exist, provide what measures were taken to determine that such areas do not exist.

Response: All wetlands on the property have been identified through the National Wetlands Inventory mapper and are shown on sheets 2 and 3 of the Site Plan.

Sheet 1 - Cover

19. Add a sheet number for the Conceptual Landscape Plan within the Sheet Index Table.

Response: Sheet number added to Sheet Index Table.

20. Align the project site within the Vicinity Map to accurately depict the project location.

Response: Vicinity Map moved to accurately depict the project location.

21. Development Area Lot Coverage calculations shall be provided to the Town prior to issuing the first building permit or approving construction documents.
for each Development Area.

Response: Understood.

Sheet 2 - Overall Site Plan

22. While the Lodge Trail is depicted on the southwest portion of the property, there has been extensive discussions about additional trails (formal and social) throughout the property. Please generally delineate where these trails are and whether or not public access to each trail is anticipated to be allowed over the project property. If public access is granted, appropriate easements will be required to be recorded with the Grand County Clerk and Recorder.

Response: The proposed trails within the property have been identified on this sheet. In addition, the existing northern trail leading to RMNP has been identified.

23. The Typical Roadway Section diagrams depicted on Sheet's 2 and 3 of the site plan are inconsistent. Please amend so they are consistent.

Response: The roadway sections on Sheet 3 have been amended to match the section provided on Sheet 2 of the Site Plan. As depicted, the ultimate bench will be 18-feet in width; however, we have also modified the detail to provide an option for a 9' bench to accommodate 0° Parking where topographical challenges exist.

24. Amend the paving type legend for existing asphalt road to reflect what is showing on the Site Plan.

Response: The existing asphalt road layering has been updated in the sheets.

Sheet 3 - Site Plan

25. This sheet is getting very crowded and difficult to read and understand all information shown. Consider separating some of the items into another sheet to more clearly understand the specific site layout and features. For example, can the Phasing lines and utilities be removed from this sheet since they are depicted on Sheet 4?

Response: Agreed. Phasing lines and sanitary/water lines have been removed to improve clarity. All can be found on Sheet 4.

Engineering Comments

See attached redlines.

Response: Redlines have been addressed on their respective sheets (see attached).

For Your Information

The following comments are for your information and relate to future approvals, standards, or regulations necessary for the development actions requested. No action is necessary at this time on these items.

26. There are water improvements required to be extended throughout the property to service all proposed development. Such improvements shall not commence until appropriate
construction documents, cost estimates, and sureties are submitted, reviewed, and approved by the Town.

Response: Understood.

27. The Site Plan was reviewed with the understanding that as each phase, as identified on the Site Plan, is built, Construction Documents, as required by Sec. 9-1-1(B)5, will be submitted to the Town for review and approval prior to any work commencing on the property within that given phase and will need to consist of the following:
   a. Cover sheet
   b. General and Specific notes sheet(s)
   c. Survey control sheets
   d. Roadway section(s) sheet with pavement / roadway section design
   e. Roadway Plan and Profile Sheets
   f. Sanitary Sewer Plan and Profile Sheets
   g. Storm Sewer Plan and Profile Sheets
   h. Water Layout Sheets
   i. Detailed Grading Plans with contours and spot elevation
   j. Detention pond grading and detail sheets
   k. Detail sheets for roadway, parking, striping, signs, utilities, etc.
   l. Erosion control plans
   m. Erosion control details

Response: Understood.

28. There are areas where the maximum slope exceeds 3:1. A stability report or analysis may be required in conjunction with Construction Documents for areas steeper than 3:1 (in some case up to 1.5:1).

Response: Understood. Those items will be addressed by the Geotechnical Report which is currently in process.

I trust these responses are sufficient to address staff's concerns. Should you have any additional questions/concerns or require additional information, please feel free to contact

Sincerely,

Bowman Consulting Group, Ltd.

[Signature]

Christopher L. Perdue, P.E., M.B.A.
Engineering Team Leader
November 30, 2018

National Park Service
Rocky Mountain National Park
Estes Park, CO 80517
Attention: Darla Sidles

Re: Grand Lake Lodge Land Use Application
Responses to 3rd Submittal Review Comments

Dear Darla,

I am in receipt of your letter dated November 1st, 2018 and would like to formally respond to questions and concerns expressed therein.

This letter will focus primarily on the three items outlined in Paragraph 3; fire hazards, setback from the park boundary and traffic safety. I have outlined our response to reach point below.

Fire Hazards: As discussed during our call on November 30th, our team is willing to undertake the process necessary to obtain a Special Use Permit to remove trees along the Grand Lake Lodge/Rocky Mountain National Park interface along our northern and western boundary. In addition, our team will work collaboratively with the Grand Lake Fire Protection District to aid in removal efforts on the Grand Lake Lodge Property as well.

Setback from the Park Boundary: As discussed on November 30th, our team feels as though the 30-foot setback from the Park Boundary is sufficient. The Town of Grand Lake’s Zoning Regulations currently requires a 5-foot setback adjacent to the Park Boundary per Paragraph 12-2-17. The Town’s Zoning Regulations states “buffer yards shall be constructed to mitigate problems with noise, glare, dust, pollution, conflicting land uses, loss of privacy, unsightly views and other potentially negative effects”. Based on our proposed use and compliance with current Town regulations regarding lighting, building materials, etc. our team feels as though we have mitigated the defined need for a buffer sufficiently to justify a 30-foot setback.

Traffic Safety: As discussed during our call on November 13th, our team is agreeable to constructing turn lanes as part of Phase I of the project. Our team will work with Park Service Personnel to provide the documentation needed to obtain a Special Use Permit for their construction. Our team will be following up on the Traffic Comments provided on November 13th in a separate memorandum. As agreed, these issues can be further resolved once we commence the Construction Drawing development and approval process.

On behalf of the Grand Lake Lodge Development Team, I would like to formally thank you and each one of your team members for the detailed review and comments and we look forward to continuing this collaborative approach while we strive to make our Project a success for our client and the Town of Grand Lake.

Should you have any additional questions/concerns or require additional information beyond that provided herein, please feel free to contact me directly at CPerdue@bowmanconsulting.com.
Sincerely,
Bowman Consulting Group, Ltd.

Christopher L. Perdue, P.E., M.B.A.
Engineering Team Leader
November 30, 2018

Colorado Headwaters Land Trust  
P.O. Box 1938  
Granby, CO 80446  
Attention: Jeremy D. Krones

Re: Grand Lake Lodge Land Use Application  
Responses to 3rd Submittal Review Comments

To Mr. Krones,

I am in the receipt of your letter dated October 30th on the subject referenced Land Use Application. I appreciate the Land Trust's detailed review of our application and offer the following responses based upon the scope and nature of our development and specific language contained in the Deed of Conservation Easement (DCE) (Grand County Reception #2001-012789).

Paragraph Two of your letter specifically states that the drainage improvements depicted on Page 92 of the Phase III Drainage Report are not allowed per Subsections D and M of Section 5 of the DCE. Upon review of the DCE, Subsections D and M of Section 5 are specific to the "property" which is defined by Exhibit A as the 14.174 acre "Easement". The improvements described on Page 92 are not located within the Easement and therefore we fully comply with Subsections D and M. No grading is proposed within the Easement area. Our stormwater management facilities have been designed to release historic rates into existing outfall locations along the Property’s southern boundary and therefore no adverse effects are anticipated.

Please also note that the proposed stormwater management facilities are a requirement imposed by the current Town of Grand Lake and Grand County requirements. Our engineering team has designed the facilities to mitigate any impacts to the Conservation Easement Area to the extent feasible while meeting current regulations.

I apologize for the delayed response highlighted in Paragraph Three. Our team is working with the Town to ensure that all material is provided to the Land Trust in a timely manner.

Should you have any additional questions/concerns or require additional information, please feel free to contact me directly at CPerdue@bowmanconsulting.com.

Sincerely,

Bowman Consulting Group, Ltd.

[Signature]

Christopher L. Perdue, P.E., M.B.A.  
Engineering Team Leader
December 15, 2018

Christopher Perdue
Bowman Consulting Group, LTD.,
603 park Point Drive, Ste 100
Golden, CO 80401

**SENT VIA E-MAIL**

RE: Referral Agency Comments for Fourth Review of Grand Lake Lodge PD Amendment and Site Plan

Dear Mr. Perdue,

On December 4, 2018, the above-mentioned application and supplemental materials was sent to the referral agencies for review and comments. The following agencies have been provided the application for review, but has not returned any comments:

- Mountain Parks Electric, Inc.*
- Grand Lake Fire Protection District
- Town of Grand Lake Water Department
- Colorado Headwaters Land Trust

The following agencies have provided comments related to the application which must be adequately addressed by the applicant and/or owner:

- **RG & Associates:** TJ Dlubac: 970-744-0623 and Gary Welp: 303-901-2447
  o See attached comments.

- **Rocky Mountain National Park:** Darla Sidles, RMNP Superintendent; Darla_Sidles@nps.gov
  o See attached comments.

- **Mountain Parks Electric, Inc.:** Jean Johnston at JeanJ@mpei.com or 970-887-7065 or Jim Beck at jbeck@mpei.com or 970-887-7073
  o * While RGA has not yet received formal comments from MPEI, based on conversations town staff has had with their representatives, we anticipate comments forthcoming from MPEI. Please reach out to their representative to discuss any potential concerns or issues they may have with the project.*

Please review the comments included in this letter. If you have specific questions about an agencies comments, please contact the reviewer directly.

Make appropriate and necessary changes and re-submit the PD Amendment and Site Plan packages for review by SPM Wednesday, December 26th.

If you have any questions, please contact me at 970-744-0623 or at TJDlubac@rgengineers.com.
Sincerely,

RG AND ASSOCIATES, LLC

[Signature]

TJ Dlubac, AICP
Sr. Planning Manager

Encl: Rocky Mountain National Park
      RGA Review Comments

Cc: Francis Corso, Red Tail Acquisition
    Nathaniel Shull, Grand Lake Town Planner
IN REPLY REFER TO:
A3815 (ROMO)

Mr. Nate Shull, Town Planner
Town of Grand Lake
P.O. Box 99
Grand Lake, CO 80447

Dear Mr. Shull:

In response to the fourth submission of the Planned Development Plan Amendment for the Grand Lake Lodge, we gratefully acknowledge that the applicant and Town of Grand Lake addressed many of our earlier concerns and that the documentation in the fourth submission generally reflects those conversations. However, we have one remaining significant unresolved issue, the 50 foot setback we requested. By comparison, there is a 100 foot buffer on the development’s southern boundary, as part of a conservation easement. We feel strongly that it is incongruous to accept a mere 30 foot buffer on the northern boundary with the National Park Service (NPS). Our proposed 50 foot setback is a compromise to a preferred 100 foot buffer, which would better protect park resources and provide a larger wildland fire and hazard tree buffer.

After several discussions among the applicant, park staff, and Town staff, we have come to a mutual understanding on the other two major issues of fire mitigation and safety improvements at the intersection of Trail Ridge Road (Highway 34) and the Lodge access road.

Fire Mitigation

The applicant has expressed an interest in applying for a Special Use Permit to conduct fire mitigation activities on the park along the northern boundary. The applicant would be responsible for all costs associated with the project, including NPS staff time to review and monitor the project. While no application has been received to date, this option may address our mutual concerns about hazard trees and fire.

Safety at the Intersection

We met with the applicant by phone on November 13, and we agreed that intersection improvements at Trail Ridge Road (Highway 34 and the Grand Lake Lodge access road) would be needed. All planning, compliance, permitting, and construction costs for such improvements would be borne by the applicant. The park would issue a special use permit for construction. Once accepted by the NPS, the park will be responsible for maintenance of the improvements.

In addition to the three major issues, we have the following comments and minor edits to the final PDP Amendment:
1. **PDP Cover Page Item 20:** We request that the intersection improvements be executed with Phase I and accepted by NPS before the Town issues an occupancy permit. We would like to see Item 20 updated to reflect this agreement. Suggested text as follows:

*The applicant and the National Park Service have agreed that safety improvements are needed at the intersection of the Lodge access road and Trail Ridge Road (Highway 34). All planning, compliance, permitting, and construction costs will be borne by the applicant. Acceptance of the improvements by NPS must occur prior to the issuance of the occupancy permit.*

2. **PDP Cover Page Item 21:** Keeping the maximum allowable height of buildings to 35 feet should protect park viewsheds.

3. **PDP Cover Page Item 24:** We look forward to working with the applicant and the Town of Grand Lake on the required Invasive and Exotic Plant Management Strategy. This note requires the applicant to follow this document for any earthwork with a disturbance of 1000 square feet or any soil within 30 feet of the park boundary. *We suggest that this note requiring the Invasive and Exotic Plant Management Strategy be added to the Conceptual Landscape Plan as well. We request that the disturbance distance be increased to within 100 feet of the park boundary.*

4. **PDP Cover Page Item 26:** This note requires a Final Landscape Plan be submitted to the Town with the building permit. Because the Final Landscape Plan will include locations for lights, signs, fences, and other furnishings, we request that the NPS be kept informed and allowed to review the plan.

5. **PDP Cover Page Item 28:** We concur with the requirement to adhere to dark sky friendly lighting. This will help protect the park’s dark skies and allow visitors and guests to enjoy night sky viewing.

6. **PDP Cover Page Item 29:** This note requires fences and signs to direct guests to established park trailheads and trails. The addition of proposed trails on the site plan is helpful to understand the applicant’s intent. This should help protect sensitive resources just inside the park boundary. We will work with the Lodge owners on visitor use concerns as they arise.

7. **PDP Cover Page, Request a New Note:** As agreed upon in our many discussions with the Town and applicant, we request that you add an additional note to this section requiring the applicant to work with the Town and NPS to minimize impacts to the park during construction. Suggested language:

*During construction, the applicant and Lodge owners will work with the Town and the NPS to minimize impacts to the park such as timing to avoid the elk rut and wildlife migration; minimizing noise; and preventing the spread of invasive exotic plants by using certified weed-free seed, mulch, and riprap within 100 feet of the park boundary.*

8. **Conceptual Landscape Plan:** We appreciate the goals of naturalistic design and use of native plants set forth in the Conceptual Landscape Plan. The Conceptual Landscape Plan notes that the Final Landscape Plan will “include proposed lighting fixtures and locations, erosion control materials..., quantities and location of selected plant species and trees, ... and locations of signage, benches, trash enclosures, and other site amenities.” *We request adding to this list the location and design of fences.*
9. **Drainage Report:** Section 4.3 notes that an Erosion and Sediment Control Plan will be provided. We request that both the Drainage Report, the forthcoming Erosion and Sediment Control Plan, and the construction drawings and specifications require that seeding, riprap, and mulching materials utilized within 100 feet of the park boundary should be certified weed-free to prevent the spread of invasive exotic plants into the park.

10. **Site Plan:** We request that a note be added to the site plan clarifying the situation with the utility lines in the access road. Specifically as part of our review, we discussed with the Town and the applicant that an easement across USA lands had been filed with the county without NPS permission and is therefore invalid. For that reason, the easement stops at the park boundary, as shown on the site plan. We request entering a note on the drawings that clarifies that the utility line is allowed via permit across USA lands. We suggest modifying the site plan note to read:

   *Ingress/Egress & Utility Easement Reception No. 2006010518, terminates at boundary. Existing utility lines in access road allowed by NPS Permit.*

One final minor note: the Utility Report and Drainage Report introductions appear inconsistent. The number of additional units listed in the Utility Report is 92 rental units and the Drainage Report states the number is 86.

We look forward to working with the Town and the applicant to implement these recommendations. Please continue to send correspondence to my office. The park lead for this project is Cheri Yost, Park Planner. She can be reached at CherI_Yost@nps.gov or (970) 586-1320.

Sincerely,

Darla Sidles
Superintendent
December 14, 2018

Christopher Perdue
Bowman Consulting Group, LTD.
603 Park Point Drive, Suite 100
Golden, CO 80401

RE: Planned Development Plan Amendment Review #4
Grand Lake Lodge
RGA Job No.: 1119.0003

Dear Mr. Perdue:

On November 12, 2018 RG and Associates, LLC (RGA) received the following items for the Planned Development Plan (PD) request:

- Deed of Conservation Easement, Middle Park Land Trust, dated December 21, 2001
- Grand Lake Lodge Open Space Baseline Documentation Report, dated December 2001

On December 1, 2018 RGA received the following items for the Planned Development Plan (PD) request:

- Planned Development Plan Comment Response Plans, revise date November 30, 2018
- Site Plan Comment Response Plans, revise date November 30, 2018
- RG and Associates, LLC Email 11/20 Comment Response Letter, dated November 29, 2018
- RG and Associates, LLC Letter Comment Response Letter, dated November 29, 2018
- National Park Service Comment Response Letter, dated November 30, 2018
- Colorado Headwaters Land Trust Comment Response Letter, dated November 30, 2018
- Utility Report, revision dated August 30, 2018
- Site Plan, revision dated November 30, 2018
- Planned Development Plan, revision dated November 30, 2018
- Amended Drainage Report, dated November 30, 2018

Please review the comments below. If you disagree with a comment, check the “No” box and indicate the reason for your disagreement. All comments must have a response. Please contact TJ Dlubac at tjdubac@rgengineers to obtain an electronic version of this letter in Word format to better facilitate your response.
1. We understand that changes to the phase shown in this set of plans may occur due to financial issues, the timing of approval and the wetlands that may existing within the area of Pond B (Phases I and IV). It is our understanding that Construction Plans will be provided on a Phase by Phase basis that will include the necessary items (this will include updates or new studies and/or reports based upon the greater level of detail provided).

**PLANNED DEVELOPMENT PLAN**

**Planning Comments**

2. Remove “Employee Housing” from the Maximum Units column of the Zoning Standards Table (Sheet 1 PDP) within the Employee Lodge Development Area.

Complied: □ Yes □ No

Response: ____________________________

3. There are discrepancies in the acreages of the various Development Areas between the original PDP and the latest proposed PDP. Please explain the reason for these areas being different sizes and why the areas were shifted.

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Original Acreage</th>
<th>Proposed Acreage</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake</td>
<td>8.8</td>
<td>7.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Knoll</td>
<td>6.4</td>
<td>7.7</td>
<td>-1.3</td>
</tr>
<tr>
<td>Employee Lodge</td>
<td>7.5</td>
<td>7.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Existing Lodge</td>
<td>12.4</td>
<td>14.3</td>
<td>-1.9</td>
</tr>
<tr>
<td>Conservation Easement</td>
<td>15.6</td>
<td>14.1</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50.7</strong></td>
<td><strong>50.9</strong></td>
<td><strong>-0.2</strong></td>
</tr>
</tbody>
</table>

Complied: □ Yes □ No

Response: ____________________________

**SITE PLAN**

**Engineering Comments**

*Sheet 4*

[Link to document provided]
4. The Pond B area should be labeled as "Phase I".

Complied: □ Yes  □ No
Response: _________________________________

5. Add a note that no construction will be allowed within Pond B or areas tributary to Pond B until the appropriate permits, approvals or alternative stormwater mitigation measures are designed and in-place.

Complied: □ Yes  □ No
Response: _________________________________

FOR YOUR INFORMATION
The following comments are for your information and relate to future approvals, standards, or regulations necessary for the development actions requested. No action is necessary at this time on these items.

6. There were water improvements required to be extended throughout the property to service all proposed development. Such improvements shall not commence until appropriate construction documents, cost estimates, and sureties are submitted, reviewed, and approved by the town.

7. The Site Plan was reviewed with the understanding that as each phase, as identified on the Site Plan, is built, Construction Documents, as required by Sec. 9-1-1(B)5, will be submitted to the Town for review and approval prior to any work commencing on the property within that given phase and will need to consist of the following:
   a. Cover sheet
   b. General and specific notes sheet(s)
   c. Survey control sheets
   d. Roadway section(s) sheet with pavement/roadway section design
   e. Roadway Plan and Profile Sheets
   f. Sanitary Sewer Plan and Profile Sheets
   g. Storm Sewer Plan and Profile Sheets
   h. Water Layout Sheets
   i. Detailed Grading Plans with contours and spot elevation
   j. Detention pond grading and detail sheets
   k. Detail sheets for roadway, parking, striping, signs, utilities, etc.
   l. Erosion control plans
   m. Erosion control details
8. There are areas where the maximum slope exceeds 3:1. A stability report or analysis may be required in conjunction with Construction Documents for areas steeper than 3:1 (in some cases up to 1.5:1).

9. All previous comments provided on the Utility Report have been addressed. With limited level of detail provided at the PD stage it may be required that new utility reports, updates to this report, additional calculations or supporting information may be needed or requested with the greater level of detail provided with the Construction Plans for each respective phase.

10. All previous comments made on the Phase III Drainage Report have been addressed. With limited level of detail provided at the PD stage it may be required that new drainage reports, updates to this report, additional calculations or supporting information may be needed or requested with the greater level of detail provided with the Construction Plans for each respective phase.

**NEXT STEPS**
Comments contained in this letter and attached as redlines, if any, are based on the documents submitted to date. Please contact TJ Dlubac at 970-744-0623 with any questions.

Sincerely,

RG AND ASSOCIATES, LLC

TJ Dlubac, AICP
Senior Planning Manager

Gary E. Welp, P.E., CFM
Senior Project Manager

Cc: Nate Shull, Grand Lake Town Planner

December 18, 2018

RG and Associates, LLC
Attn: TJ Blubac & Gary Welp
561 Blue River Parkway, Suite 1A
PO Box 862
Silverthorne, CO 80498

Re: 020379-01-001 Grand Lake Lodge – Comment Response No. 5
RGA Job No.: 1119.0003:01

To Mr. Blubac & Mr. Welp,

The following are our responses to your comments dated December 15, 2018 regarding the above referenced project:

ROCKY MOUNTAIN NATIONAL PARK

1. However, we have one remaining significant unresolved issue, the 50 foot setback we requested. By comparison, there is a 100 foot buffer on the development’s southern boundary, as part of a conservation easement. We feel strongly that it is incongruous to accept a mere 30 foot buffer on the northern boundary with the National Park Service (NPS). Our proposed 50 foot setback is a compromise to a preferred 100 foot buffer, which would better protect park resources and provide a larger wildland fire and hazard tree buffer.

Response: These concerns have been noted. As discussed previously, the underlying zoning for the property permits a Front and Side Yard Setback of 5 feet. Our design team has reviewed the Wildland Urban Interface Code and discussed our proposal of a 30-foot setback with the Grand Lake Fire Protection District which has initially stated this was adequate with respect to fire protection. As indicated, our team will be obtaining a Special Use Permit to assist the Park with strategic tree removal along the properties northern and western boundaries. The conservation easement should be considered a separate matter. This easement was not granted nor intended to serve as a buffer.

Currently, the Town of Grand Lake’s land development code states “buffer yards shall be constructed to mitigate problems associated with noise, glare, dust, pollution, conflicting land uses, loss of privacy, un-sightly views and other potentially negative effects”. With fire prevention being the key factor behind the proposed 30-foot defensible space, the remaining items outlined which would facilitate a buffer in excess of 30-feet are not warranted.

Additionally, our team completed an impact analysis should we provide a 50-foot setback in lieu of a 30-foot setback. Should the buffer increase we would lose a total of 13 units. This reduction in density would significantly impact the project’s proposed financing plan due to a reduction in revenue required to offset infrastructure development costs. If a 50-foot buffer were proposed along the
northern and western boundaries, it would encumber approximately 3.67 acres. In the current proposal, 0.11 acres of new development (or 3.00% of the total 50-foot buffer acreage) is proposed within the 3.67 acres.

2. The applicant has expressed an interest in applying for a Special Use Permit to conduct fire mitigation activities on the park along the northern boundary. The applicant would be responsible for all costs associated with the project, including NPS staff time to review and monitor the project. While no application has been received to date, this option may address our mutual concerns about hazard trees and fire.

Response: Yes, we will submit a Special Use Permit for mitigation.

3. We met with the applicant by phone on November 13, and we agreed that intersection improvements at Trail Ridge Road (Highway 34 and the Grand Lake Lodge access road) would be needed. All planning, compliance, permitting, and construction costs for such improvements would be borne by the applicant. The park would issue a special use permit for construction. Once accepted by the NPS, the park will be responsible for maintenance of the improvements.

Response: Yes, this comment is confirmed.

Comments to the Final PDP Amendment:

4. PDP Cover Page Item 20: We request that the intersection improvements be executed with Phase I and accepted by NPS before the Town issues an occupancy permit. We would like to see Item 20 updated to reflect this agreement. Suggested text as follows:

   The applicant and the National Park Service have agreed that safety improvements are needed at the intersection of the Lodge access road and Trail Ridge Road (Highway 34). All planning, compliance, permitting, and construction costs will be borne by the applicant. Acceptance of the improvements by NPS must occur prior to the issuance of the occupancy permit.

Response: Note #20 is updated.

5. PDP Cover Page Item 21: Keeping the maximum allowable height of buildings to 35 feet should protect park viewsheds.

Response: Note unchanged, the 35-foot maximum allowable height was kept.

6. PDP Cover Page Item 24: We look forward to working with the applicant and the Town of Grand Lake on the required Invasive and Exotic Plant Management Strategy. This note requires the applicant to follow this document for any earthwork with a disturbance of 1000 square feet or any soil within 30 feet of the park boundary. We suggest that this note requiring the Invasive and Exotic Plant Management Strategy be added to the Conceptual Landscape Plan as well. We request that the disturbance distance be increased to within 100 feet of the park boundary.

Response: Note modified.

7. PDP Cover Page Item 26: This note requires a Final Landscape Plan be submitted to the Town with the building permit. Because the Final Landscape Plan will include locations for lights, signs, fences, and other furnishings, we request that the NPS be kept informed and allowed to review the plan.

Response: Your concerns are understood. All future applications will be submitted and processed in accordance with the Town of Grand Lake's current Land Development Code.
8. PDP Cover Page Item 28: We concur with the requirement to adhere to dark sky friendly lighting. This will help protect the park's dark skies and allow visitors and guests to enjoy night sky viewing.

Response: Noted, no action.

9. PDP Cover Page Item 29: This note requires fences and signs to direct guests to established park trailheads and trails. The addition of proposed trails on the site plan is helpful to understand the applicant's intent. This should help protect sensitive resources just inside the park boundary. We will work with the Lodge owners on visitor use concerns as they arise.

Response: Our team will work collaboratively with the National Park Service to provide directional signage within the limits of the subject property as required to protect sensitive resources. The National Park Service should provide additional signage within the Park Boundary as deemed necessary.

10. PDP Cover Page, Request a New Note: As agreed upon in our many discussions with the Town and applicant, we request that you add an additional note to this section requiring the applicant to work with the Town and NPS to minimize impacts to the park during construction. Suggested language:

During construction, the applicant and Lodge owners will work with the Town and the NPS to minimize impacts to the park such as timing to avoid the elk rut and wildlife migration; minimizing noise; and preventing the spread of invasive exotic plants by using certified weed-free seed, mulch and riprap within 100 feet of the park boundary.

Response: Note added.

11. Conceptual Landscape Plan: We appreciate the goals of naturalistic design and use of native plants set forth in the Conceptual Landscape Plan. The Conceptual Landscape Plan notes that the Final Landscape Plan will "include proposed lighting fixtures and locations, erosion control materials, Quantities and location of selected plant species and trees, and locations of signage, benches, trash enclosures, and other site amenities." We request adding to this list the location and design of fences.

Response: Note modified.

12. Drainage Report: Section 4.3 notes that an Erosion and Sediment Control Plan will be provided. We request that both the Drainage Report, the forthcoming Erosion and Sediment Control Plan, and the construction drawings and specifications require that seeding, riprap, and mulching materials utilized within 100 feet of the park boundary should be certified weed-free to prevent the spread of invasive exotic plants into the park.

Response: Drainage Report section updated.

13. Site Plan: We request that a note be added to the site plan clarifying the situation with the utility lines in the access road. Specifically as part of our review, we discussed with the Town and the applicant that an easement across USA lands had been filed with the county without NPS permission and is therefore invalid. For that reason, the easement stops at the park boundary, as shown on the site plan. We request entering a note on the drawings that clarifies that the utility line is allowed via permit across USA lands. We suggest modifying the site plan note to read:

Ingress/Egress & Utility Easement Reception No. 2006010518, terminates at boundary. Existing utility lines in access road allowed by NPS Permit.

Response: Site Plan update.
14. One final minor note: the Utility Report and Drainage Report introductions appear inconsistent. The number of additional units listed in the Utility Report is 92 rental units and the Drainage Report states the number is 86.

Response: Rental units within the Utility Report have been updated to 86.

RG AND ASSOCIATES

General Comments

Engineering Comments

15. We understand that changes to the phases shown in this set of plans may occur due to financial issues, the timing of approval and the wetlands that may existing within the area of Pond B (Phases I and IV). It is our understanding that Construction Plans will be provided on a Phase by Phase basis that will include the necessary items (this will include updates or new studies and/or reports based upon the greater level of detail provided).

Response: Yes, construction plans will be submitted on a phase by phase basis.

Planned Development Plan

Planning Comments

16. Remove “Employee Housing” from the Maximum Units column of the Zoning Standards Table (Sheet 1 PDP) within the Employee Lodge Development Area.

Response: “Employee Housing” has been removed.

17. There are discrepancies in the acreages of the various Development Areas between the original PDP and the latest proposed PDP. Please explain the reason for these areas being different sizes and why the areas were shifted.

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</tr>
</tbody>
</table>

Response: The proposed acreage is based on an updated topographic survey dated 11/07/17. Both the development areas and the total parcel area of 54.36 acres has been confirmed with the updated survey and PDP.

Site Plan

Planning Comments

Sheet 4 – Utility Master Plan

18. The Pond B area should be labeled as “Phase I”.

Response: Label added.

19. Add a note that no construction will be allowed within Pond B or areas tributary to Pond B until the appropriate permits, approvals or alternative stormwater mitigation measures are designed and in-place.

Response: Note added.
For Your Information

The following comments are for your information and relate to future approvals, standards, or regulations necessary for the development actions requested. No action is necessary at this time on these items.

20. There were water improvements required to be extended throughout the property to service all proposed development. Such improvements shall not commence until appropriate construction documents, cost estimates, and sureties are submitted, reviewed, and approved by the town.

Response: Noted.

21. The Site Plan was reviewed with the understanding that as each phase, as identified on the Site Plan, is built, Construction Documents, as required by Sec. 9-1-1(B)5, will be submitted to the Town for review and approval prior to any work commencing on the property within that given phase and will need to consist of the following:

a. Cover sheet
b. General and Specific notes sheet(s)
c. Survey control sheets
d. Roadway section(s) sheet with pavement / roadway section design
e. Roadway Plan and Profile Sheets
f. Sanitary Sewer Plan and Profile Sheets
g. Storm Sewer Plan and Profile Sheets
h. Water Layout Sheets
i. Detailed Grading Plans with contours and spot elevation
j. Detention pond grading and detail sheets
k. Detail sheets for roadway, parking, striping, signs, utilities, etc.
l. Erosion control plans
m. Erosion control details

Response: Noted.

22. There are areas where the maximum slope exceeds 3:1. A stability report or analysis may be required in conjunction with Construction Documents for areas steeper than 3:1 (in some cases up to 1.5:1).

Response: Noted.

23. All previous comments provided on the Utility Report have been addressed. With limited level of detail provided at the PD stage it may be required that new utility reports, updates to this report, additional calculations or supporting information may be needed or requested with the greater level of detail provided with the Construction Plans for each respective phase.

Response: Noted.

24. All previous comments made on the Phase III Drainage Report have been addressed. With limited level of detail provided at the PD stage it may be required that new drainage reports, updates to this report, additional calculations or supporting information may be
needed or requested with the greater level of detail provided with the Construction Plans for each respective phase.

Response: Noted.

I trust that the responses provided herein are sufficient to address your comments and concerns.

Thanks,
Bowman Consulting Group, Ltd.

Christopher L. Perdue, P.E., M.B.A.
Team Leader
MEMORANDUM

To: Nate Shull, Grand Lake Town Planner

From: Scotty P. Krob, Grand Lake Town Attorney

Date: November 21, 2018

Re: Grand Lake Lodge application

This memorandum is being provided to summarize my discussions with the Grand Lake Lodge development applicant’s attorney regarding two issues that have been raised in the previous proceedings before the Grand Lake Planning Commission.

1. Section 3(b) of the 1960 Memorandum of Agreement between the United States National Park Service and the Colorado Transportation Company.

Neighboring land owners raised a concern that the proposed development of the Grand Lake Lodge Property that is the subject of the pending application (“the Property”) violated Section 3(b) which limited lodging and other uses on certain lands described in the Memorandum. The matter was referred to the National Park Service, who consulted with their attorney (the U.S. Solicitor’s office). The Solicitor provided an answer to the Park Service in which he indicated that the limitation in Section 3.b. applies only “to lands lying within the Park boundaries...” and that the Property that is the subject of the pending application is not within the Park boundaries and therefore not subject to the Subsection 3(b) limitations.

On October 3, 2018, I emailed Mr. Kent Whitmer, the attorney representing the nearby land owners, and advised him of what had occurred and the Solicitor’s opinion. I also asked that if Mr. Whitmer believed for any reason that the Solicitor’s conclusion was in error, to notify me within 10 days or the Town would assume that the Solicitor’s opinion adequately addressed his client’s concerns.
Ten days from the date of my email expired on October 13, 2018. Despite the passage of more than a month and a half since I apprised Mr. Whitmer of these matters, I have not heard anything further from him by email or otherwise. Therefore, my conclusion is that the Solicitor is correct and that the limitations of Section 3(b) of the 1960 Memorandum of Agreement do not apply to the property that is currently be considered by the Planning Commission.

2. Restrictive Covenants

Subsequent to the correspondence regarding the Memorandum of Agreement discussed above, I was advised that the nearby property owners had also raised an issue as to whether certain Covenants limited what could be done with the Property. I spoke with the applicant’s attorney, Marc Painter. He indicated they have done substantial title work and anticipate being able to demonstrate to the Planning Commission that the Covenants, like the Memorandum of Agreement, do not apply to or limit what they seek to do in their application. Assuming such materials are provided at the continuation of the hearing on this application, the Restrictive Covenants also do not appear to limit what the applicant seeks to do.

If you have any questions or need anything further, please let me know. I look forward to seeing you and the Planning Commission at the continuation of the hearing of this matter on December 5, 2018.
February 11, 2019

To: Mayor Peterson and Town Trustees

From: Jim White, Town Manager

RE: Middle Park Health Lease

PURPOSE

Over the course of the past year (2018), the Town staff and elected officials have gradually moved closer to leasing a portion of the Grand Lake Center to Middle Park Health to bring a medical clinic to the Town of Grand Lake for a minimum of three years initially. Discussions thus far have been predominantly supported by Town Staff, the Town Board and the general public. Three Lakes Water and Sanitation District has agreed to suspend any additional tap fees for the initial three-year period. Middle Park Health has represented that the clinic would be available, most likely, three days in the winter and four days during the summer.

STAFF COMMENTS and RECOMMENDATION

Staff is bringing forward a copy of the formal Lease Agreement that has been reviewed by the Middle Park Health Attorney and the Town Attorney. Negotiations among the Board members may still occur to refine or revise any outstanding issues from either party. This Lease Agreement is being brought forward in Executive Session at the February 11, 2019 meeting for further Town Board consideration. Following the Executive Session, the Town Board may be ready to take action.

The current target opening date for the Medical Clinic in Grand Lake at the Grand Lake Center in the current proposal would be on or about June 1, 2019.

SUGGESTED MOTION

I move to approve the Lease Agreement between the Town of Grand Lake, a Colorado statutory municipality, and Kremmling Memorial Hospital District, a quasi-municipal corporation and Colorado Special District, doing business as Middle Park Health. This Agreement shall initially be in place for a period of three years; OR,

P.O. BOX 99, GRAND LAKE, COLORADO 80447-0099
PH. 970/627-3435
FAX 970/627-9290
E-MAIL town@townofgrandlake.com
I move to approve the Lease Agreement between the Town of Grand Lake, a Colorado statutory municipality, and Kremmling Memorial Hospital District, a quasi-municipal corporation and Colorado Special District, doing business as Middle Park Health, with the following stipulations:

This Agreement shall initially be in place for a period of three years; OR,

I move to reject the Lease Agreement between the Town of Grand Lake, a Colorado statutory municipality, and Kremmling Memorial Hospital District, a quasi-municipal corporation and Colorado Special District, doing business as Middle Park Health.
East Grand School District and Squeaky B's in Grand Lake will be hosting a Master planning meeting on February 18th @ 6:00 pm.

All EGSD patrons are invited to attend to learn about and give feedback on the many different options possible to handle our growing and changing District. It is important that our improvements, both physical (buildings and grounds) and in terms of vision (what is best for our kids) reflect the values of all stakeholders.

PLEASE JOIN US AND HELP EAST GRAND SCHOOL DISTRICT CONTINUE TO EXCEL.