CALCULATIONS ANALYSIS

CO_2 Reduction:

eCo_2 Greetings and ezeep each have collated data from other sources to determine the following estimates:

- 1.2 kilograms of carbon dioxide (CO_2) are emitted per kilogram of non-recycled paper produced; 0.7 kg of CO_2 are emitted per kg of recycled paper produced (ezeep).
- A single sheet of standard office paper weighs approximately 5 grams, because standard office paper has a weight of approximately 80 grams per square meter (g/m^2) and each square meter of paper contains about 16 pages (ezeep).
- Laser printers, which are what is used in the Planning and Building Department office, have CO_2 emissions of around 10.27 g per minute and there is an assumption that 10 pages are printed per minute. A significant proportion of this estimate is from the warm-up time associated with heating the fuser assembly to the correct operating temperature, requiring around 1300 watts. Ezeep claims that the 15 watts associated with using inkjet printers is negligible for carbon calculations and appears omit the emissions associated with the production of ink and toner (ezeep). Ink and toner would be negligible on a page-by-page calculation, but at an office-wide scale, they likely should not be overlooked.
- Approximately 29 g of CO_2 are emitted during the process of sending a handwritten posted letter (eCo_2 Greetings). Because this is handwritten, this value omits printing emissions but may or may not omit the cost of producing the presumed single page of paper. Given that, on average, that would be a difference of 1 gram of CO_2. That may be negligible on a per mailing basis, until we calculate the many pages associated with decision notifications.
- Approximately 4 grams of CO2 are emitted from sending an email without an attachment, but approximately 19 grams are emitted from an email with a 1 megabyte attachment (MB) (eCo_2 Greetings).
- An email with large or multiple attachments can emit up to 50 g of CO_2 (eCo_2 Greetings).
- Approximately 7.07 kg of CO_2 are emitted from the power consumption associated with transmitting 1 gigabyte (GB) of data.
- Webpage sources:
  - https://www.ezeep.com/co2-neutral-printing/
  - https://www.ezeep.com/wp-content/uploads/A-Paper-Free-Future.pdf
  - https://www.eco2greetings.com/News/The-Carbon-Footprint-of-Email-vs-Postal-Mail.html

The analysis below extrapolates from that data, which was likely established with more separation between each aspect of the process and is therefore less accurate with each

mathematical step and is dependent on some rough estimates. These are secondary sources that each have commercial biases, ezeep sells software and hardware to support networked printers and eCo_2 Greetings sells e-cards. Because the intent of the code change is to save costs, staff time was not spent finding each source of their data and re-compiling it into a new conclusion, as such an endeavor could potentially have exceeded the annual savings to be determined further below.

Without values from the Planning and Building Department, the values listed above and the determinations made by each source are insufficient to support preference between email or physical mail because they change based on scales of activity, though both support a reduction in both choices for CO_2 reducing efforts. A duplication between the efforts, regardless, is wasteful in terms of CO_2 emissions, as well as staff and materials cost. The values below are specific to the Planning and Building Department and are used to tailor the calculations to the Department's needs.

- The paper currently used by the Planning and Building Department is made from 30% post-consumer waste, so the calculations interpret it to have output 30% as much as recycled paper, plus 70% as much as non-recycled paper.
- A typical Approval Packet can be around 20 pages, sometimes shorter, sometimes significantly longer.
- A randomly selected, though recent, Approval Packet of that length was approximately 4.1 megabytes (MB)
- A notice that the appeal period has ended would not be greater than 2 pages.
- The notice associated with the random Approval Packet referenced above was 0.2 MB.
- Both of these items are sent out as a result of each decision.

With these data, we can convert the CO_2 emitted per page and per email values into a CO_2 emitted per decision value that can be compared. For clarity, this value is only an assessment of emissions that would be changed with the decision to require emails only and omits the emissions from the many other steps in the decision-making process.

Because there would be two mailings or two emails per decision and a flat value associated with each act of sending, but the differing page counts leads to different end-values for each, we will add twice the flat CO_2 grams of each sent item to the total CO_2 grams per decision (g/DC). Therefore, we will use the 29 grams per mailing to establish 58 (g/DC) added and the 4 CO_2 grams per email to establish 8 (g/DC).

Next, CO_2 grams per printed page and per MB. eCo_2 Greetings and ezeep differ significantly on CO_2 per MB calculations. The 7.07 kg/GB from ezeep is equal to 7.07 g/MB,

as the conversions of both grams to kilograms and megabytes to gigabytes are factors of 1,000. eCo_2 Greetings' estimate of 19 grams per email with 1 MB attachment certainly includes the flat value of sending an email without an attachment, but while simple subtraction may be inappropriate considering the variables involved, to simplify the math overall, we'll say that would logically lead to 15 g/MB. Interestingly, the entity with an interest in potential customers sending more e-cards claims twice as many grams of CO_2 per megabyte are emitted than the entity with an interest in potential customers printing out their documents. For the calculations, we'll use the greater value. To calculate the impacts of the semi-post-consumer paper used by the Planning and Building Department: 30% of 0.7 CO_2 grams per gram of recycled paper equals 0.21 CO_2 grams, 70% of 1.2 CO_2 grams per gram of non-recycled paper equals 0.84 CO_2 grams, the sum of which is 1.05 CO_2 grams per gram of the semi-post-consumer paper. At 5 grams per page, multiplied by 1.05 CO_2 grams, that results in CO_2 emissions of 5.25 CO_2 grams per page. At 10.27 CO_2 grams emitted per 10 pages, CO_2 emitted from the energy associated with printing each page is 1.027 CO_2 grams per page. Adding the energy costs of producing each page with the energy costs of printing on each page, the Planning and Building Department would need to emit roughly 6.277 CO_2 grams per printed page.

Using 15 g/MB and 6.277 g/page, combining the counts from both the Approval Packet and Appeal Completion Letter to get 4.3 megabytes per decision and 22 pages per decision, then we can multiply to find CO_2 emissions of 64.5 g/DC for email data and 138.09 g/DC for printed pages. Adding the flat emissions of 8 g/DC for emails, we find approximately 72.5 g/DC when emailing only. Adding the flat emissions of 58 g/DC for mailings, we find approximately 196.09 g/DC when mailing only. This is a difference of 63%, a significant reduction that is beyond expected error rates from the approximations. Using the same calculations but substituting the 15 g/MB value for 7.07 g/MB, the difference could be as much as 80%.

However, we also must recall that presently, the Planning and Building Department is both mailing and emailing these notices, so the values should also be added together before finding a potential percent reduction. That addition results in 268.59 CO_2 grams emitted per decision. Considering the Planning and Building Department would nearly exclusively email these notices as a result of this code change, using the potential usage of 72.5 g/DC, the potential reduction in CO_2 emissions associated with this step of this task would be roughly 73%.

Economic Savings:

Planning Staff assessed the time spent on preparing and sending the notices for each decision and determined that approximately 30 minutes are spent to prepare and email the notices, plus an additional 15 minutes to mail them out. Multiplying that time by the 297 decisions made requiring these mailings, between the Planning Commission, Zoning Administrator, and Administrative decisions in the previous year (2024), approximately 222.75 hours are expected to be spent annually. Multiplying the time by the staff burden rate, then adding the mailing costs, such as postage, that are billed to the applicant, the total costs are approximately $31,482.44 annually.

Reducing the time spent to 30 minutes, only 148.5 hours are required for the task annually. If the same number of decisions are made, then by removing the cost of mailing from the equation but increasing the burden rate to the current fiscal period's rate, the total costs would be approximately $20,614.77 annually. The savings, therefore, would be approximately $10,867.67 annually.

The reduced costs associated with the reduction in paper and envelope usage have not been calculated as part of this analysis.