

July 27, 2012

MEMORANDUM

TO: John Tindall, P.E.
Engineering Manager, Coeur d'Alene Regional Office

FROM: Jennifer Wester, P.E.
Staff Engineer, Technical Services

SUBJECT: Staff Analysis for Draft Reuse Permit WRU M-0229-01 (Municipal Recycled Water)
Cave Bay Community Services, Inc.

1. PURPOSE

The purpose of this memorandum is to satisfy the requirements of the *Recycled Water Rules*, IDAPA 58.01.17.400.05, for issuing reuse permits. This memorandum addresses draft reuse permit WRU M-0229-01, for the municipal treatment and recycled water system owned and operated by Cave Bay Community Services, Inc.. This is a new permit for Cave Bay Community Services, Inc..

2. SUMMARY OF EVENTS

The Idaho Department of Environmental Quality (DEQ) received a permit application from Cave Bay Community Services, Inc. (CBCS) on September 23, 2011, which largely serves as the basis for the terms and conditions contained in the draft permit. CBCS and DEQ have entered into a Compliance Agreement Schedule (CAS) **dated** in response to an overflow of their wastewater storage lagoon. In February 2011, CBCS notified DEQ that Lagoon #2 had nearly overtopped its berm. System users were notified of the emergency and asked to reduce wastewater flow to the system. Sandbags and plastic sheeting were used to keep the wastewater from flowing over the lagoon berm and effluent was truck hauled to the City of Worley's wastewater treatment facility. DEQ granted a temporary waiver on February 11, 2011 to allow limited irrigation of forested property adjacent to the lagoons to keep the lagoon levels down until the evaporation rate exceeded the influent flow rate. Due to the expectation that influent flows plus precipitation will continue to exceed evaporation rates, CBCS has applied for a permit to irrigate a forested site on the 3-acre parcel owned by CBCS adjacent to the parcel containing the lagoons. CBCS has also received a wastewater planning grant from DEQ and is working on the preparation of a wastewater treatment facility planning document and environmental information document. This planning effort will provide the basis for upgrading the facility to meet current requirements and allow CBCS to apply for funding from state/federal agencies for design/construction of the selected alternative.

As required by the *Recycled Water Rules*, the draft permit will be presented for a public comment period. After the comment period has closed, DEQ will provide written responses to all relevant comments and prepare a final permit for the CBCS recycled water system.

3. PROCESS AND SITE DESCRIPTIONS

The Cave Bay community wastewater system, constructed in 1977, consists of individual septic tanks that pump effluent into a septic tank effluent pump (STEP) collection system with small-diameter, low-pressure transmission lines. Flows from each area are pumped to a centralized lift station. There are four lift stations in the system with the lower ones pumping up to the higher ones until the collected effluent reaches Lift Station #3 which discharges into a wet well above the lagoons. The wastewater is gravity fed into Lagoon #1 which is a

0.5-million gallon (MG) aerated lagoon providing primary treatment. Lagoon #2 can hold approximately 2.6 MG and was designed as the final polishing/storage lagoon. The system was designed to be total containment, relying on evaporation and seepage from the unlined lagoons to dispose of the wastewater. Since there is an overflow/underdrain pipe on Lagoon #2, the draft permit includes a monthly bacteria monitoring requirement if there is any flow from this pipe.

As described in Section 2 above, the storage capacity in the lagoons is not adequate for total containment as the system was approved in 1977. Disposal of the lagoon effluent is now required and truck hauling or irrigation are currently the best options. The CAS will include a schedule for completing the upgrade of the facility by 2015. The proposed draft permit will be effective until the permit expiration date or a permit modification is required to after the upgrades are completed.

The Cave Bay community is located along the west shore of Cave Bay on the west side of Coeur d'Alene Lake (see Appendix 1, Vicinity Map). The lagoons and proposed 3-acre irrigation site are located northwest of the development, just over the ridge into the 16 to 1 Bay drainage (see Appendix 1, Site Map). The irrigation site is currently forested.

On October 13, 2011, CBCS received a Conditional Use Permit from Kootenai County for the development of a recycled water irrigation system on the 3-acre forested site proposed in the reuse permit application (Kootenai County, 2011).

4. DISCUSSION

The following sections outline the site conditions and terms of the draft permit, based on the *Recycled Water Rules* and any other applicable regulatory standards.

4.1. Soils

Soil at the CBCS irrigation site has been characterized by the United States Department of Agriculture National Resource Conservation Service (USDA-NRCS). Soil data were taken from the Web Soil Survey available online at <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> and descriptions are from the Soil Survey of Kootenai Area, Idaho (USDA-NRCS, 1981).

According to NRCS data, soils at the irrigation site primarily consist of Lacy-Rock outcrop complex, 5 to 35 percent slopes with some areas of Lacy-Bobbitt association, 35 to 65 percent slopes.

Lacy-Rock outcrop complex, 5 to 35 percent slopes, is found on rolling to steep mountainsides and canyons where there are basalt bedrock outcrops and consists of approximately 55% Lacy stony loam, 35% Rock outcrop, and the remaining 10 % is Blinn stony loam and Bobbitt stony loam. The Lacy material is a shallow, well-drained soil that formed in material weathered from basalt with some loess in the upper part of the profile. Average depth to bedrock is nineteen (19) inches. The available water capacity of the soil is low with moderate permeability, rapid runoff and a very high erosion hazard. The Lacy soil is listed as suitable for unmanaged stands of Ponderosa pine and Idaho fescue.

Lacy-Bobbitt associate, 35 to 65 percent slopes, is found on mountain slopes and terrace escarpments and consists of approximately 55% Lacy soil, 35% Bobbitt soil, with the remaining 10% consisting of Blinn stony loam, 35 to 65 percent slopes and Rock outcrop. The Bobbitt soil is a moderately deep, well-drained soil formed from material weathered from basalt with some loess and volcanic ash. Average depth to bedrock is thirty-five (35) inches with most of this soil occurring in concave areas. The available water capacity is low, permeability is moderate with rapid runoff and very high erosion

hazard. The Bobbitt soil is listed as suitable for unmanaged stands of Douglas fir and Ponderosa pine.

From field observations submitted with the Technical Report (CBCS, 2011), the proposed irrigation site has few rock outcrops and depth to bedrock in the three test pits was around nine (9) feet. The site is generally heavily forested with healthy Douglas fir and Ponderosa pine.

4.2. Ground Water

Depth to groundwater in the area around the irrigation site is dependent on elevation. From the logs for wells drilled in Sections 29 and 32, the wells closer to the lake (such as the domestic supply wells for CBCS) have water depth between 65 and 70 feet below ground surface (bgs). For wells located back into the hills, water depth appears to be between 246 and 415 feet. The well logs were searched online at <http://www.idwr.idaho.gov/apps/appswell/searchWC.asp> on December 7, 2011.

CBCS proposes to install three piezometers at the site to measure depth to groundwater in order to maintain at least three (3) feet of soil between the surface and groundwater during irrigation.

4.3. Surface Water

From available maps, there are two surface waters in the vicinity of the irrigation area. Lake Coeur d'Alene is approximately 900 feet to the northwest (16 to 1 Bay) and 1500 feet to the east by southeast (Cave Bay), and there is an unnamed drainage into 16 to 1 Bay that passes within approximately 1000 feet of the site. The site is located over the ridge from Cave Bay in the 16 to 1 Bay drainage. Runoff from the site would likely impact the 16 to 1 Bay drainage below the lagoon site due to the nature of the soils in the area, as described in Section 4.1 above.

4.4. Hydraulic Management Unit Configuration

CBCS proposes three hydraulic management units (HMUs) for the irrigation site (CBCS, 2011). Due to pumping limitations (30 gpm), each area is limited to less than ten (10) sprinkler heads with a capacity of 3 gpm each. Table 1 shows the proposed serial numbers and acreages for the individual HMUs. Altogether the site will consist of 3.29 acres.

Table 1 CBCS Proposed HMUs

Serial Number	Description	Acres
MU-022901	Area #1	1.28
MU-022902	Area #2	0.82
MU-022903	Area #3	1.19

4.5. Wastewater Flows and Constituent Loading Rates

The following sections discuss wastewater flow rates and rationale for constituent and hydraulic loading rates appearing in the draft permit.

4.5.1. Wastewater Flows

Annual influent to the lagoons over the period 2006 through 2010 has ranged from 1.564 MG to 2.832 MG with the majority of the flow volume in July and August. The average flow rate used for irrigation sizing calculations was 53.3 gallons per day (gpd) per equivalent residential unit (ERU) (CBCS, 2011) which gave an estimated total influent flow of 3.288 MG for the end of the proposed permit cycle (2017) for 169 ERUs. Appendix G of the application (CBCS, 2011)

includes analysis for the minimum and maximum irrigation acreages required for 2017. A flow meter was installed in Lift Station #3 in April 2011 to accurately record influent volumes to the lagoons. Previous data used the pump hour meter multiplied by the measured operating capacity of the pumps to estimate the flow volume to the lagoon. The draft permit would require CBCS to monitor lagoon influent as a means of evaluating the effectiveness of the current HMUs to manage the incoming wastewater and determine whether additional acreage will be required.

4.5.2. Constituent Loading Rates

Hydraulic loading rate limits are generally set based on the irrigation water requirement (IWR) of the crop to be grown on the HMU. No established IWR is available for natural forests however, so DEQ is in the process of developing guidance to estimate an IWR for these systems. Evapotranspiration (ET) and precipitation deficit (P_{def}) data for “Orchards – Apples and Cherries no ground cover” and “Range Grasses – long season” are taken from the ET_{Idaho} website (<http://www.kimberly.uidaho.edu/ETIdaho/>) for the nearest station with similar characteristics (e.g., irrigated crops, elevation, latitude, etc.). In the case of CBCS, the nearest irrigated station is Coeur d’Alene 1E which is also at a similar elevation to the CBCS site (2160 feet and ~2360 feet, respectively). Table 2 summarizes the data taken from the ET_{Idaho} website for both species.

Table 2 Precipitation Deficit (P_{def}) Data

	Orchards		Range Grasses	
	mm/day	in/month*	mm/day	in/month*
January	0.03	0.037	-0.69	-0.842
February	0.13	0.143	-0.12	-0.132
March	0.24	0.293	0.04	0.049
April	0.72	0.850	0.59	0.697
May	2.16	2.636	1.76	2.148
June	4.14	4.890	2.50	2.953
July	5.76	7.030	3.57	4.357
August	4.70	5.736	2.23	2.722
September	2.68	3.165	0.59	0.697
October	0.96	1.172	-0.41	-0.500
November	-0.85	-1.004	-2.08	-2.457
December	-0.30	-0.366	-2.2	-2.685

* Calculated value (ET_{Idaho} data in mm/day / 25.4 mm/in * # days in month)

Since tree cover at the site is not complete with areas of small brush and grasses scattered throughout the application area, the canopy coverage is estimated to be 80% with a forest cover factor of approximately 0.89. For the site, a mixture of 50% orchard and 50% range grass was used as an estimate of the forest ecosystem. Table 3 shows the canopy-corrected values used for the growing season tree IWR as well as the contribution of the grasses for CBCS. Negative values represent months where little or no growth takes place.

Table 3 Canopy-corrected P_{def} Values for CBCS Trees and Grasses

Month	P_{def}^1	
	Trees ²	Grasses ³
January	0.033	-0.421
February	0.128	-0.066
March	0.261	0.024
April	0.757	0.348
May	2.346	1.074

June	4.352	1.476
July	6.257	2.179
August	5.105	1.361
September	2.817	0.348
October	1.043	-0.250
November	-0.894	-1.228
December	-0.326	-1.343

¹ Expressed in inches per month

² Table 2 value multiplied by a factor of 0.89

³ Table 2 value multiplied by a factor of 0.50 (50% site coverage)

The irrigation water requirement is intended to serve as a guide for the application of water to the crop during the growing season. Actual application rates are expected to be substantially equal to these values, allowing for variations in yearly precipitation. Table 4 shows the composited values for the growing season at the CBCS site.

Table 4 CBCS Composited Growing Season P_{def}

Month	Composited Irrigation Rates*
May	3.420
June	5.828
July	8.435
August	6.466
September	3.133
October	1.043

* Expressed in inches per month

From Table 4-12 of the Guidance (DEQ, 2007), the system efficiency was estimated to be 80% for hand lines. In order to represent the application system effectively, the values in Table 4 were divided by the efficiency of the distribution system and the resulting values are given in Table 5. The irrigation system is discussed in Section 4.4.

Table 5 IWR* for CBCS “Forest” for Sprinkler Irrigation

Month	Calculated Irrigation Rates	
	In/acre	Gallons/acre**
May	4.275	116,100
June	7.285	197,800
July	10.544	286,300
August	8.083	219,500
September	3.957	107,400
October	1.303	35,400
Total	35.448	962,500

*Based on precipitation deficit data from <http://www.kimberly.uidaho.edu/ETIdaho/stainfo.php?station=108137> for a representative mix of Orchard without groundcover and Range Grasses, assuming 80% sprinkler efficiency.
 ** Based upon conversion factor of 27,154 gallons per acre-inch.

Reuse permits typically include nitrogen loading rate limits of “150% of Typical Crop Uptake,” however CBCS proposes to irrigate forested areas adjacent to the treatment and storage lagoons which have no established uptake values. Staff intends for this permit be consistent with other permits for forested sites in the area by developing numerical constituent loading rates that are representative of the vegetation on the site. Data (Henry et al, 1999) for Douglas fir estimates nitrogen uptake for older stands (aged 25 – 40 years) at 45 lbs/acre for complete canopy and the understory at 100 lbs/acre, depending upon coverage. The draft guidance for forested sites amends the full understory nitrogen uptake to 75 lbs/acre. The Douglas fir canopy was estimated to be 80% of full canopy with 50% understory coverage, which gives a numerical value for the nitrogen limit of 92 lbs/acre, as shown by Equation 1 below. The data supplied with the application materials shows a total nitrogen concentration of 3.16 mg/L in May 2011. At the calculated IWR in Table 5, this would give a nitrogen load of approximately 25.4 lbs/acre, which is significantly less than the proposed limit.

Equation 1 Calculation of Nitrogen Loading Rate for Douglas Fir Forest

$$NL_{est} = \frac{C_{est} * N_{can} + U_{est} * N_{under}}{V_{est}}$$

Where C_{est} = estimated canopy coverage (80%)
 N_{can} = nitrogen uptake by complete canopy (45 lbs/acre-yr)
 U_{est} = estimated understory coverage (50%)
 N_{under} = nitrogen uptake by complete understory (75 lbs/acre-yr)
 V_{est} = estimated volatilization rate of applied nitrogen (0.20)
 NL_{est} = site estimated nitrogen loading limit

Solving for NL_{est} :

$$NL_{est} = \frac{C_{est} * N_{can} + U_{est} * N_{under}}{1 - V_{est}} = \frac{0.80 * 45 + 0.50 * 75}{0.80} = \frac{36 + 37.5}{0.80}$$

$$NL_{est} = 92 \text{ lbs/acre-yr}$$

Phosphorus loading limits are included in reuse permits only in cases where there is an established connection or direct threat to surface or ground water. There is one seasonal tributary approximately 1000 feet west of the site that ultimately drains north into 16 to 1 Bay (Coeur d’Alene Lake). The lake itself is approximately 900 feet to the northwest (16 to 1 Bay) and 1500 feet to the east by southeast (Cave Bay). No sampling of the tributary has been done. A runoff

control plan is included as part of Compliance Activity CA-229-01 in Section 3 of the draft permit which will address potential phosphorous-bearing sediment runoff from the irrigation site. Therefore phosphorus contamination in the nearest surface water (Coeur d'Alene Lake) from irrigation runoff should not become a concern during the permit cycle. The May 2011 sample had a phosphorus concentration of 2.28 mg/L which would result in a phosphorus load of approximately 18.3 lbs/acre if loaded at the hydraulic rates given in Table 5. Phosphorus loading on a typical forested site is around 27 lbs/acre with the majority able to be utilized by the trees (EPA, 2006). As a consequence of the low estimated loading by CBCS, staff recommends not adding a phosphorus loading limit to the draft permit. Soil and wastewater monitoring for phosphorus is recommended.

4.6. Buffer Zones and Site Management

CBCS proposes to apply Class C recycled water to 3.29 acres of forest adjacent to the existing 2-cell lagoon treatment system. Class C requires (per IDAPA 58.01.17.601.03.a.i) that “the median number of total coliform organisms shall not exceed twenty-three (23) per one hundred (100) milliliters, as determined from the bacteriological results of the last five (5) days for which analyses have been completed.” In addition, “no sample shall exceed two hundred thirty (230) per one hundred (100) milliliters in any confirmed sample.”

Table 6 lists the approximate distances from the irrigation site and lagoon to major features.

Table 6 Distance to Major Features* (in feet)

Feature	Site/Lagoon
CBCS public wells	>1650
Access road	20
Inhabited Dwelling	>500
Residential Property Line	10 – irrigation site 50 - lagoons
Lake Coeur d'Alene	>900
Domestic well	>650
Seasonal drainage	~1000

* At closest point

Due to the remoteness of the site, staff recommends the following buffer zones, based on the Guidance for the Reclamation and Reuse of Municipal and Industrial Wastewater for Class C wastewater and sprinkler irrigation:

- 300 feet from reuse site to inhabited dwellings
- 0 feet from reuse site to areas accessible by the public
- 100 feet from reuse site to permanent and intermittent surface water
- 500 feet from reuse site to private water supply wells
- 1000 feet from reuse site to public water supply wells
- 3-wire pasture fence
- Berms and other BMPs shall be used to protect the well head of on-site wells

The Idaho Wastewater Rules require wastewater treatment lagoons to be located a minimum of 200 feet from residential property lines (IDAPA 58.01.16.493.05.a). The distance from the existing lagoons to the nearest residential property line is about 50 feet to the southeast (see Table 6 above). The lagoons were constructed in 1977 prior to when this requirement in the Wastewater Rules went into effect (2007). The Odor Management Plan (see Section 4.7 below) will need to address how the odors

generated from the facility can be controlled. The Coeur d'Alene Regional DEQ Office has not received odor complaints about this facility.

The draft permit includes a requirement for maintenance of the lagoon site that includes fencing and vegetation control. This condition has been included to cover both the existing structures at the time of permitting as well as any improvements made during the upgrade process.

4.7. Other Permit Limits and Conditions

Lagoon seepage testing of the two (2) existing wastewater lagoons will not be required until the facility is upgraded. The CAS will cover the lagoon seepage requirement.

4.8. Compliance Activities

CA-229-01: A Plan of Operation (also known as an Operations and Maintenance, or O&M, Manual) is a living document and must be modified as operations and regulatory requirements change. Section 3, condition CA-229-01, as it appears in the attached draft permit, requires the facility to submit for DEQ review and approval a plan of operation which includes, but is not limited to, all of the information required by the latest revision of the Plan of Operation Checklist in the Reuse Program Guidance. The plan needs to discuss administrative and engineering controls for preventing wastewater runoff from the site and odor management, as discussed in Sections 4.5.2 and 4.6, respectively. For the full text of the condition, see CA-229-01, Section 3 of the draft permit. CA-229-02 through CA-229-04, as discussed below will be incorporated into the Plan as they are approved by DEQ.

CA-229-02: It is recommended that a Quality Assurance Project Plan (QAPP) for all monitoring activities required by this permit be prepared in order to avoid any inconsistencies in sample handling and data analysis. The QAPP is a vital part of the Plan of Operation and due to its complexity would be required as a separate compliance activity. For the full text of the condition see CA-229-02, Section 3 of the draft permit.

CA-229-03: Compliance activity CA-229-03 recommends the facility prepare a Silvicultural Plan for the irrigation site. The purpose of the silvicultural plan is to describe the facility's plan for the care and management of the trees on the irrigation site, including nutrient loading and thinning or planting, when necessary. For the full text of the condition, see Section 3 of the attached draft permit.

CA-229-04: It is recommended that the facility prepare a Waste Solids (Sludge) Management Plan as part of the updated Plan of Operation. The facility has been operated as a total containment wastewater lagoon system since 1977 and the sludge depth in the lagoons appears to be unknown at this time. The purpose of the Waste Solids Management Plan is to describe the handling and disposal of any waste solids that may be generated at the facility. DEQ guidance is available for preparing Waste Solids Management Plans (DEQ, 2011). For the full text of this activity see CA-229-04, Section 3 of the draft permit.

CA-229-05: It is recommended that the lagoon seepage testing be completed in accordance with the CAS.

CA-229-06: Per Subsection 300.01 of the Recycled Water Rules (IDAPA 58.01.17), any facility that intends to continue to operate as a reuse facility must have a permit issued by DEQ. Subsection 400.01 requires that a permit application be submitted to DEQ at least one hundred and eighty (180) days prior to the expiration of the facility's current permit. Compliance Activity CA-229-06 is proposed for inclusion in the attached draft permit so that this important deadline is not missed. For the full text, see Section 3 of the draft permit.

5. RECOMMENDATION

Based on review of applicable state rules, staff recommends that DEQ issue draft reuse permit WRU M-0229-01 for a public review and comment period. The draft permit contains effluent quality requirements for the recycled water treatment system, as well as permit limits and conditions required for operation of the system in Section 4. Monitoring and reporting requirements to evaluate system performance and to determine permit compliance have been specified in Sections 5 and 6, and compliance activities have been incorporated into Section 3 of the permit.

6. REFERENCES CITED

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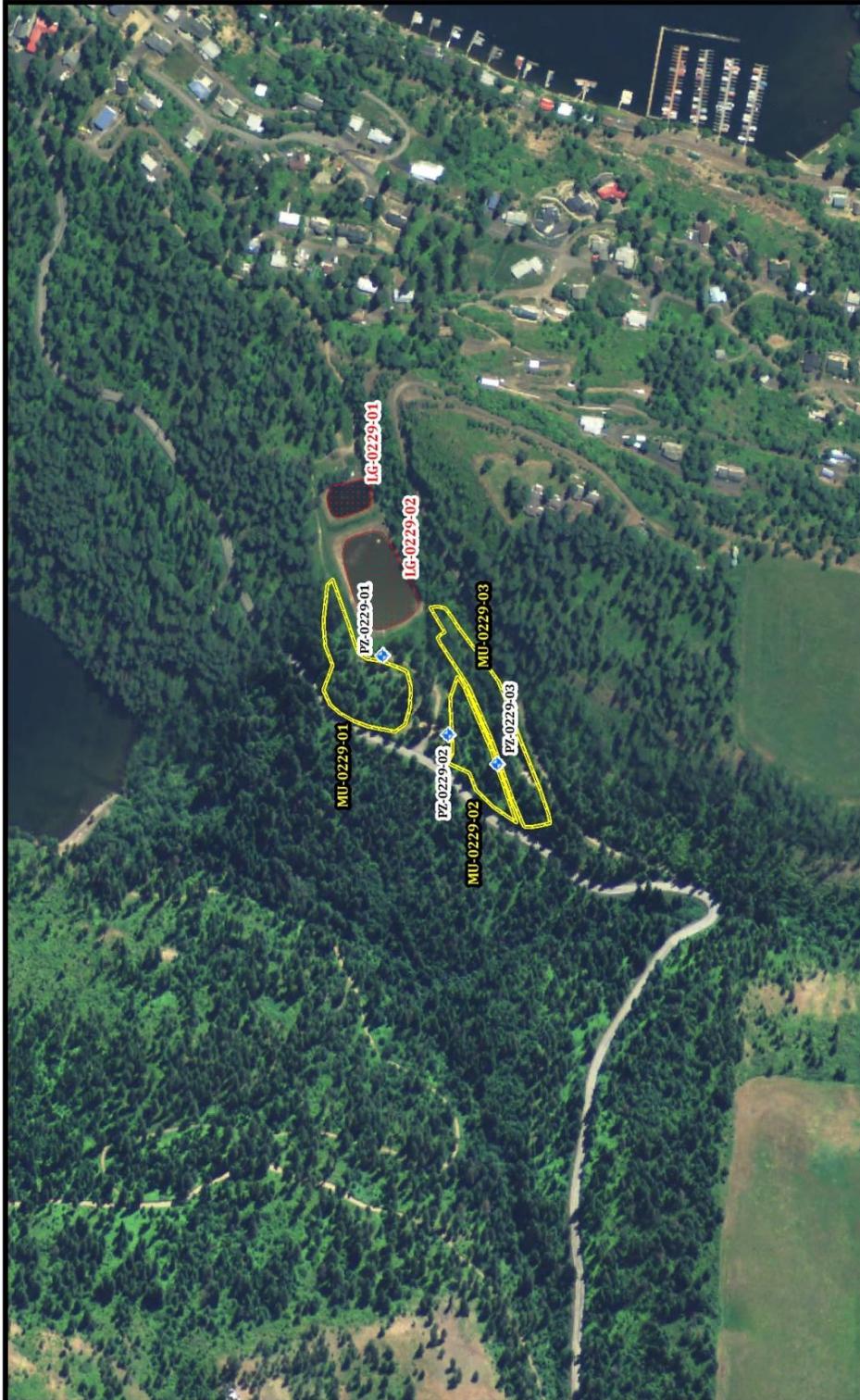
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TRIM Record 2011AGH1274

Appendix 1
Vicinity Map



Appendix 1
Site Map



Legend

- Pietzometer
- Highway
- Streams/Canals
- Lagoons
- Reuse Irrigation

Scale bar showing 0, 100, 200 Meters and 0, 400, 800 Feet.

Compass rose showing North (N), South (S), East (E), and West (W).

Cave Bay Community Services, Inc.
 WRU-M-0229-01

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