17 December 2014

Drew Lehman, Director, Environment and Planning
Recology
50 California Street, 24th Floor
San Francisco, CA 94111-9796

NOTICE OF APPLICABILITY (NOA) OF GENERAL ORDER R5-2008-0149-056, IN-SITU BIOREMEDIATION OF NITRATE PLUMES, RECOLOGY HAY ROAD, SOLANO COUNTY

Recology Hay Road (Discharger) submitted a completed Notice of Intent, dated 3 September 2014, which requested coverage under General Order No. R5-2008-0149, *General Waste Discharge Requirements for In-situ Groundwater Remediation at Sites with Volatile Organic Compounds, Nitrogen Compounds, Perchlorate, Pesticides, Semi-Volatile Compounds and/or Petroleum Compounds* (General Order). Based on information in the submittal and the conditions of concurrence described in this NOA, it is our determination that this project meets the required conditions to be approved under General Order No. 2008-0149. All of the requirements contained in the General Order are applicable to your project. You are assigned Order No. R5-2008-0149-056.

Project Location:

The project is located at the Recology Hay Road landfill in Solano County, T5N, R1E, Section 2, MDB&M. The facility is on Assessor's Parcel Nos. 42-020-02, 42-020-06, and 42-020-28; Latitude 38°18'53" N, Longitude 121°49'46" W.

Project Description:

Recology Hay Road owns and operates the Hay Road Landfill, and the Water Board regulates the facility under Waste Discharge Requirements (WDRs) Order R5-2008-0188, in part, for sewage sludge operations, green-waste composting, food-waste composting, and storage of compost leachate. Typically, compost, sewage sludge, and the related leachates have high concentrations of nitrogen compounds. These operations at the facility have caused pollution of the groundwater. Specifically, nitrate concentrations above the site-specific concentration limit of 5 mg/L have been detected in groundwater.

Water Board staff issued a notice of violation (NOV) on 8 March 2013 for nitrate above the concentration limit at a number of wells at the site. The NOV required, in part, that the Discharger perform a site investigation to delineate the nitrate releases and to establish a corrective action program. In response to the NOV, the Discharger initially proposed monitored natural attenuation, which was not approved by Water Board staff.

Subsequently, the Discharger proposed in-situ bioremediation of nitrate via subsurface injection of an amendment to stimulate bioremediation. Two areas were selected for the injection: an

area around groundwater monitoring well 4BR in the western side of the facility and an area west and south of groundwater monitoring well G-31 in the eastern side. The selected injectant/amendment is a 20-percent lactate solution. While the Discharger did not perform a pilot study with the 20-percent lactate solution, they did use information from another facility, which they stated has similar underlying soil, groundwater pollutants, and proposed injectant. Under the General Order *Condition A.3.b* and the *Notice of Intent Additional Information Requirement D i),* if the Discharger provides data from a different project location, and the provided information supports that the tested site is substantially similar to the proposed project site in regards to soil properties and makeup, then the tested site data may be used in lieu of a pilot study. In the submitted application, the Discharger asserted that the Alpha Explosive's site in Placer County was substantially similar to the Recology Hay Road landfill site.

Based on information from the Alpha site, the Discharger will inject a 20-percent lactate solution (i.e., WilClear™ Lactate Concentrate manufactured by JRW Bioremediation, LLC) at points in the area of the two impacted wells, groundwater monitoring wells 4BR and G-31. The Discharger will install seventy six injection points, and each point will be injected with 250 gallons of the 20% solution. Specifically, twenty-eight injection points will be installed in the area near well 4BR and 48 injection points will be installed in the area near well G-31, as shown in Figure 1, which is attached to this NOA. The Discharger will also inject and monitor a tracer compound to evaluate the subsurface transport of the injectant. The Discharger asserts that the injection of a 20-percent lactate solution will promote reducing conditions which will stimulate the biological degradation of nitrate to N_2 gas.

The Discharger's contingency plan will be implemented if nitrate exceeds 5 mg/L at the compliance wells, and/or if a 20% increase in the concentration of the injectant breakdown products, metals, total organic carbon, acetate, propionate, dissolved iron, dissolved manganese, alkalinity, ammonia, nitrite, or EC is observed at the compliance wells. Additionally, the contingency plan will be implemented if the groundwater outside the treatment zone has a pH outside the range of 6.5 to 8.5 Standard Units. Monitoring and Reporting Program R5-2008-0149-056 requires sampling and analyses to identify the extent of exceedance of constituents of concern, if any, related to the in-situ injection. The Discharger shall conduct sampling and shall report the results as described in the attached Groundwater Monitoring and Reporting Program. In the event of a violation of this Order (including the NOA and MRP), material change in the character, location, or volume of discharge, or if the Discharger is unable to comply with any of the conditions of this Order, the Discharger shall follow the notification requirements of Provision F8 of General Order R5-2008-0149, which includes telephone notification within 24-hours after knowledge of the incident. Written notification shall be provided within two weeks of the 24-hour notification.

On 12 November 2014, Water Board staff circulated a fact sheet (Attachment A) to interested parties describing the project. Additionally, the tentative Notice of Applicability was made available for public review on 12 November 2014. No comments were received in the 30-day comment period. The Discharger will be conducting sampling and will be reporting the results as described in the attached Monitoring and Reporting Program R5-2008-0149-056.

General Information:

1. This project will be operated in accordance with the requirements contained in the General Order, this NOA, and the MRP. In addition, this project will be operated in accordance with Water Board staff's conditions of concurrence with the 3 September 2014 NOI and work plan. The conditions of concurrence are listed below:

    a. The Discharger shall install and monitor permanent groundwater monitoring wells for monitoring the upgradient, treatment, transition, and compliance zones. At the conclusion of the project, the wells may be abandoned upon Water Board staff's approval. Temporary borings and/or wells, as proposed by the Discharger[1], are not approved for the upgradient, treatment, transition, and compliance wells. However, the injection wells will be temporary wells for a one-time injection of the amendment.

    b. **No later than 5 February 2015**, the Discharger shall submit a monitoring well installation workplan, which shall comply with the requirements of Attachment B-Section 1 to this NOA. The monitoring well installation workplan shall include the permanent wells for the six shallow groundwater monitoring locations proposed by the Discharger[2] and all the shallow temporary injection points proposed by the Discharger[3]. A list of the wells to be included in the monitoring well installation workplan is provided in the table below:

Well Location and Descriptor	Monitoring Objective
Eastern Area (shallow zone)	
EGW-3 (a.k.a. G-32)	Compliance
EGW-1	Treatment Zone
EGW-2	Transition Zone
Typical Shallow Injection Well	Amendment injection
Western Area (shallow zone)	
WGW-1	Treatment Zone
WGW-2 WGW-3	Transition Zone
Typical Shallow Injection Well	Amendment injection

    The screened interval of wells shall intersect the first encountered groundwater in a zone of preferential flow, which ranges from three to eight feet and three to twelve feet MSL[4] for the western and eastern areas, respectively. The workplan shall also include the required information for construction of the injection wells (28 in the western area and 48 in the eastern area).

    c. **No later than 30 March 2015**, a monitoring well installation report shall be submitted in accordance with Attachment B-Section 2 to this NOA.

[1] Recology Hay Road, 3 September 2014 Rev 2 Notice of Intent and Workplan
[2] Figure 10, 3 September 2014 Rev 2 Notice of Intent and Workplan
[3] Figure 10, 3 September 2014 Rev 2 Notice of Intent and Workplan
[4] Figures 4 and 7, Recology Hay Road, Rev 2 Notice of Intent and Workplan

d. **No later than April 2015**, the injection of the amendment shall be completed at all amendment injection wells specified in this Order.

e. If the nitrate concentration at all the wells listed in Table 1 of MRP R5-2008-0149-056 for the project do not meet the concentration limit of 5 mg/L by **30 March 2017**, then the project will be terminated by the Executive Officer and the Discharger shall submit an updated Engineering Feasibility Study no later than **30 April 2017** for additional corrective action measures.

f. Thirty days after project termination, as approved by the Executive Officer, the Discharger shall submit a monitoring well abandonment workplan in accordance with the requirements of Attachment C to this NOA.

2. Upon Water Board staff's approval, the scientific data, results, and transport properties obtained during this project may be used to develop a work plan under the General Order to remediate other areas and depths at the facility which are impacted by nitrates.

3. The required annual fee (as specified in the annual billing you will receive from the State Water Resources Control Board) shall be submitted until this Notice of Applicability is officially revoked.

4. Injection of materials other than the approved 20-percent lactate solution (i.e., WilClear™ Lactate manufactured by JRW Bioremediation) into the subsurface is prohibited.

5. Failure to abide by the conditions of the General Order, Water Board staff's conditions of concurrence, and MRP R5-2008-0149-056 could result in an enforcement action as authorized by provisions of the California Water Code.

6. Pursuant to Water Code Section 13267, the Discharger shall comply with the attached Monitoring and Reporting Program, Order No. R5-2008-0149-056 and any revisions thereto as ordered by the Executive Officer. The first quarterly monitoring report is due no later than **1 August 2015** and the first annual report is due no later than **1 February 2016.** Monitoring reports shall be submitted until a Notice of Termination is issued.

If you have questions, please contact Mary Boyd at mboyd@waterboards.ca.gov or (916) 464-4676.

ORIGINAL SIGNED BY ANDREW ALTEVOGT FOR

PAMELA C. CREEDON
Executive Officer

Enclosures: Attachment A, Attachment B, Attachment C, Monitoring and Reporting Program R5-2008-0149-056, Figure 1, General Order R5-2008-0149, and 1 March 1991 Standard Provisions and Reporting Requirements

cc w/o enclosures:
Mayumi Okamuto, Office of Enforcement, State Water Board, Sacramento
Dave Weiss, Solano Co. Environmental Health Services Division, Fairfield
Greg Pryor, Recology Hay Road, Vacaville
Bryan Clarkson, Recology, Dixon

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-2008-0149-056

FOR
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES, SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

RECOLOGY HAY ROAD
JEPSON PRAIRIE ORGANICS AS A DBA OF RECOLOGY HAY ROAD
RECOLOGY HAY ROAD LANDFILL
SOLANO COUNTY

This Monitoring and Reporting Program (MRP) describes requirements for monitoring an in-situ groundwater remediation system. This MRP is issued pursuant to Water Code Section 13267. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. As appropriate, Central Valley Water Board staff shall approve specific sample station locations prior to implementation of sampling activities.

All samples shall be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form.

The monitoring and reporting required by this MRP is different and separate than that required by the Title 27 Waste Discharge Requirements program, and as such the monitoring reports required by the two programs shall be submitted separately.

GROUNDWATER MONITORING

The groundwater monitoring program for this Order includes all the wells specified in Table 1 and any additional wells related to the in-situ remediation project installed subsequent to the adoption of the MRP. As shown on Figure 1 and as described in the Notice of Applicability (NOA), there are upgradient, treatment zone, transition zone, compliance zone, and injection wells. The tables below identify the wells which will be monitored as part of the in-situ bio-remediation project.

Sample collection, analysis, method detection limits, and practical quantitation limits shall follow the requirements in this MRP R5-2006-0149-056. All trace concentrations, which are those values reported by the laboratory between the method detection limit and practical quantitation limit, shall be reported.

Samples shall be collected according to the schedule in Table 1, and shall be monitored by the field parameter and analytical methods in Table 2. Feld parameters shall be monitored each time a monitoring well is sampled.

Table 1: Sampling Frequency and Constituent Suite for Groundwater Monitoring Wells[1]

Well Number*	Pre-Injection Suite	Monthly Suite for First Three Months (April, May, June 2015)	Quarterly Suite From Second** Quarter 2015 until Termination	Monitoring Objective
EASTERN AREA WELS (SHALLOW ZONE)				
EGW-3/G-32, G-16, G-20, G-25, G-28, G-29, G-30	A	B	A	Compliance[2]
EGW-1	A	B	A	Treatment Zone[3]
EGW-2	A	B	A	Transition Zone[4]
G-19R & G-26	A	B	A	Upgradient[5]
WESTERN AREA WELLS (SHALLOW ZONE)				
G-10M/G-10R & G-11M/G-11R	A	B	A	Compliance[2]
4BR & TWGW-1	A	B	A	Treatment Zone[3]
WGW-2, WGW-3, MW-4, & G-27	A	B	A	Transition Zone[4]
G-2	A	B	A	Upgradient[5]

***** All EGW and WGW wells need to be installed.

****** Provided that sampling occurs on the same day and that all constituents in Suite A and B are monitored, then the second quarter 2015 sampling event may be combined with a monthly sampling event.

[1] Wells must be installed no later than March 2015. Constituent suite components are listed in Table 2.

[2] Compliance Zone wells are used to determine compliance with groundwater limitations.

[3] Treatment Zone wells are sampled to evaluate in-situ bioremediation progress inside the treatment zone.

[4] Transition Zone wells are sampled to evaluate migration of pollutants. The transition zone is the area where ambient groundwater mixes with the treatment zone groundwater.

[5] Upgradient Zone wells are sampled to evaluate conditions upgradient of the treatment zone.

Table 2: Analytical Methods and Field Parameters*

Suite A–Pre-Injection and Quarterly Monitoring			
Analytical Parameters (units)	Method	Maximum Method Detection Limit (MDL) **	Maximum Practical Quantitation Limit (PQL)
Total Dissolved Solids (mg/L)	2540C	10.0	10.0
Nitrate as nitrogen (mg/L)	EPA 300.0 (as N)	0.018	0.1
Nitrite as nitrogen (mg/L)	EPA 300.0 (as N)	0.025	0.1
Ammonia as nitrogen (mg/L)	SM-4500-NH3 (as N)	0.025	0.05
Total Kjeldahl Nitrogen (mg/L)	4500-N-org	0.056	0.2
Total Organic Carbon (mg/L)	415.1 as TOC	0.13	0.3
Sodium, total (mg/L)	EPA 6010B	0.05	0.5
Iron, dissolved (mg/L)	EPA 6010B	0.005	0.05
Manganese, dissolved (mg/L)	EPA 6010B	0.001	0.01
Bicarbonate alkalinity (mg/L)	SM 2320B	4.1	4.1
Organic Acids (ug/L) (acetate & propionate)	EPA 300.0	0.025	0.1
Bromide tracer (mg/L)	EPA 300.0	0.035	0.1
Field Parameters*	Units		
Groundwater elevation	±0.01-feet MSL		
pH	pH Units (to 0.1 units)		
Temperature	°C		
Turbidity	NTU		
Dissolved oxygen	mg/L		
Electrical Conductivity	uhmos/cm		
Oxidation-Reduction Potential	Millivolts		
Suite B–Monthly Monitoring			
Analytical Parameters	Method	Maximum Method Detection Limit (MDL)*	Maximum Practical Quantitation Limit (PQL)
Nitrate as nitrogen (mg/L)	EPA 300.0 (as N)	0.018	0.1
Nitrite as nitrogen (mg/L)	EPA 300.0 (as N)	0.025	0.1
Ammonia as nitrogen (mg/L)	SM-4500-NH3 (as N)	0.025	0.05
Total Kjeldahl Nitrogen (mg/L)	4500-N-org	0.056	0.2
Total Organic Carbon (mg/L)	415.1 as TOC	0.13	0.3
Bromide (tracer) (mg/L)	EPA 300.0	0.035	0.1
Field Parameters*	Units		
Groundwater elevation	±0.01-feet MSL		
pH	pH Units (to 0.1 units)		
Temperature	°C		
Turbidity	NTU		
Dissolved oxygen	mg/L		
Electrical Conductivity	uhmos/cm		
Oxidation-Reduction Potential	Millivolts		

* Calibration requirements on Page 4 of MRP R5-2008-0149-056 shall be implemented for field parameters

** Any concentration between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.

Calibration of Field Sampling Instruments and Recording and Reporting of Calibration Records

Field test instruments (such as those used to test pH, dissolved oxygen, electrical conductivity, ORP, temperature, and turbidity) may be used provided that:

1. Training. The operator is trained in proper use and maintenance of the instruments;
2. Calibration. The instruments are calibrated prior to each monitoring event;
3. Servicing. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Recording and Reporting. Field calibration reports are submitted as described in item (b) of the "Reporting" section of this MRP.

DISCHARGE MONITORING

The Discharger shall monitor daily any discharge of water and amendments that are injected into the groundwater according to the requirements specified in Table 3. Each amendment addition shall be recorded individually, along with information regarding the time period over which the amendment was injected into the aquifer.

Table 3: Discharge Monitoring Requirements

Parameter	Units/Other	Type of Sample
Injected Volume per point	gallons per day	Flow meter
Amendment(s) Added per point	kilograms per day	Measured
Bromide tracer added per point, along with the injection well number and location where tracer is added[1].	1. milligrams per day per point 2. Well ID numbers and locations	Measured

[1] Injection wells where bromide tracer is added shall also be shown on a site map.

AMENDMENT ANALYSIS

Prior to each injection, amendments shall be analyzed for the constituents listed in Table 4. The analysis shall be done once on the pure amendment and once on the mixture of the amendment with deionized water at the estimated concentration that would be injected during the in-situ bioremediation project described in the NOA.

Table 4: Amendment Analytical Requirements

Constituent	Method	Maximum Practical Quantitation Limit (ug/L)[1]
Volatile Organic Compounds	EPA 8260B	0.5
General Minerals[2]	Various	Various
Metals, Total and Dissolved[3]	EPA 6010B and 7470A	Various
Semi-Volatile Organic Compounds	EPA Method 8270	2.0
Total Dissolved Solids	2540C	10,000
pH	meter	NA
Electrical Conductivity	meter	NA

[1] All concentrations between the Method Detection Limit (MDL) and the Practical Quantitation Limit shall be reported, and shall be reported as an estimated value. The MDLs shall be those listed in Table 2 of this MRP, and as approved by Water Board staff.

[2] General Minerals include analysis of total concentrations for: sodium (EPA 6010B), alkalinity (SM2320B), bicarbonate (SM2320B), bromide (EPA 300.0), potassium (EPA 6010B), chloride (EPA 300.0), sulfate (EPA 300.0), nitrate as N (EPA 300.0), nitrite as N (EPA 300.0), ammonia as N (SM-4500-NH3), and hardness (EPA 130.2).

[3] Metal analysis for total and dissolved mercury via EPA 7470A. All other total and dissolved metals via EPA 6010 B for arsenic, barium, cadmium, calcium, total chromium, copper, iron, lead, manganese, magnesium, molybdenum, nickel, selenium.

NOTIFICATION AND REPORTING

This section outlines procedures for performing notifications and for reporting.

Notifications

The Discharger shall perform the following notifications whenever the following conditions occur:

1. Contingency Plan. **Telephone notification shall be made within 24 hours and written notification shall be made within 14 days after knowledge that the Discharger's contingency plan was implemented**. The Discharger's contingency plan will be implemented whenever nitrate exceeds 5 mg/L at the compliance wells, and/or if a 20% increase in the concentration of the injectant breakdown products, metals, total organic carbon, acetate, propionate, dissolved iron, dissolved manganese, alkalinity, ammonia, nitrite, or EC is observed at the compliance wells. Additionally, the contingency plan will be implemented if the groundwater outside the treatment zone has a pH outside the range of 6.5 to 8.5 Standard Units.

2. Violations and Other Conditions. In the event of a violation of the General Order, the NOA, or MRP R5-2008-0149-056, a material change in the character, location, or volume of discharge, or if the Discharger is unable to comply with any of the conditions of this Order, the Discharger shall follow the notification requirements of Provision F8 of General Order R5-2008-0149, which includes **telephone notification within**

24-hours after knowledge of the incident and **written notification within 14 days of the 24-hour telephone notification.**

The Discharger is prohibited from following the notification procedures in their 3 September 2014 Rev 2 Notice of Intent and Workplan.

Reporting

When reporting the monitoring data, the Discharger shall arrange the information in tabular format so that the date, units, volumes, flow rates, constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner to illustrate clearly the compliance with this Order or lack thereof, including whether nitrate as nitrogen exceeds the concentration limit of 5 mg/L at any well listed in Table 1 and whether any parameter exceeds the limits in the contingency plan at the compliance wells.

The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall also be reported to the Regional Board, and shall be reported in the quarterly report for the quarter in which the samples were obtained.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all reports shall be prepared by a California registered professional or their subordinate and signed by the registered professional.

The Discharger shall submit electronic data, reports, and plans which conform to the requirements of the California Code of Regulations, Title 23, Division 3, Chapter 30. All reports, plans, and data required under this Order shall be uploaded to the state's GeoTracker system and the Discharger shall submit email notification of each upload to the Water Board. To upload electronic reports and to provide the email notification, the Discharger shall do the following steps:(1) Upload the entire report, plan or data to GeoTracker. Reports and plans shall include the transmittal letter and the signed certification statement as the first page(s) of the report. Record the Geotracker Confirmation Number after you have completed the upload; (2) Edit the table below to show (a) the date and title of the report and/or data you uploaded to GeoTracker and (b) your GeoTracker confirmation number; (3) copy and paste the updated table into the body of an email; (4) finally, send the email notification with the updated table to centralvalleysacramento@waterboards.ca.gov

Title and Date of Report	**Add the title and date of the report which you uploaded to Geotracker here into this cell.**
Geotracker Confirmation No.	**Add your Geotracker confirmation number here into this cell.**
Contact	Mary Boyd
Regulatory Program	Land Disposal
Unit	Compliance
Regulated Party Name (Discharger)	Recology Hay Road
Facility Name	Recology Hay Road

County	Solano
CIWQS Place ID	244435

Quarterly Reports:
Quarterly reports are due to the state's GeoTracker system by the f**irst day of the second month following the end of each calendar quarter**. Email notification of the uploads are due at the same time as the quarterly reports. Under this MRP, the first quarterly report is due **by 1 August 2015.** In summary quarterly reports are due by the dates shown in the table below:

Quarterly Monitoring Period and Reporting Schedule

Quarter	Monitoring Period	Report Due Date
First	1 January – 31 March	1 May
Second	1 April – 30 June	1 August
Third	1 July – 30 September	1 November
Fourth	1 October – 31 December	1 February

Each quarterly report shall include the following minimum information:

(a) A transmittal letter, which shall include:

i. The date, report title (e.g., Second Quarter 2015 Monitoring Report, Recology Hay Road, R5-2008-0149-056), the facility name, and Order number.
ii. Whether or not the contingency plan was implemented during the monitoring period or any previous monitoring period.
iii. Whether or not the contingency plan needs to be implemented.
iv. Any violations of the General Order, NOA, and/or MRP R5-2008-0149-056 (including the violations outlined in Provision F8 of the General Order) found since the last quarterly report was submitted and whether telephone and written notification were provided to Water Board staff regarding the violation.
v. If any violations have been found since the last quarterly report was submitted, then a description of the actions taken or planned for correcting those violations shall be included.
vi. If no violations have occurred since the last quarterly report, then this shall be stated.
vii. The signed penalty of perjury statement by the Discharger, or the Discharger's authorized agent, as described in the Standard Provisions General Reporting Requirements Section B.3.

(b) A description and discussion of the groundwater sampling events and results, including statistical trends and time-series trends of the concentrations of pollutants; groundwater elevations in the wells; how and when samples were collected; and whether the pollutant plume(s) is delineated.

(c) A map showing all groundwater injection and monitoring points required for this Order. For clarity and readability, the landfill gas (LFG) extraction and monitoring points shall not be included on this map.

(d) Groundwater elevation contour maps for each groundwater zone.

(e) Pollutant iso-concentration maps for each groundwater zone (zones shall not be combined on one map).

(f) A table showing well construction details including the well number, groundwater zone being monitored, groundwater elevation, coordinates (longitude and latitude), ground surface elevation, reference elevation, elevation of the top of the screen ,and the bottom of the screen interval, elevation of bentonite, elevation of filter pack, and elevation of well bottom. All elevations shall be in feet mean sea level;

(g) A table showing historical lateral and vertical (if applicable) flow directions and gradients;

(h) The status of the ongoing corrective action and in-situ bioremediation effort, including an estimate of the cumulative mass of nitrate pollutant removed from the subsurface, the effectiveness of the bio-remediation effort, and any field notes pertaining to the operation and maintenance of the remediation system.

(i) The reasons for and the duration of any interruptions in the operation of any remediation effort, the actions planned or taken to correct and prevent interruptions, and whether the Water Board staff was notified.

(j) In a format acceptable by Water Board staff, cumulative data tables, on a CD/DVD in .xlxs format, containing the cumulative water quality analytical results, units, qualifiers, dates, laboratory analytical methods, PQLs, MDLs, field parameters, and depth to groundwater. Any abbreviations used in the table must be consistent throughout the entire table, including but not limited to abbreviations for parameters and analytical methods. An acceptable format i is shown below:

Location ID	Date	Analytical Method	Analyte	Results	PQL	MDL	Laboratory Qualifiers	Units
MW-1	Mm/dd/yy	8260B	TCE	.004	.005	.0025	J	mg/L
MW-1	Mm/dd/yy	8260B	DCE	ND	.005	.0025		mg/L
MW-1	Mm/dd/yy	8260B	MTBE	40	25	12		ug/L
MW-2	Mm/dd/yy	8260B	TCE	.6	.005	.0025		mg/L
MW-2	Mm/dd/yy	8260B	DCE	10	.005	.0025		mg/L
MW-2	Mm/dd/yy	8260B	MTBE	<.12	25	12	B	ug/L
MW-3	Mm/dd/yy	8260B	TCE	.6	.005	.0025		mg/L
MW-3	Mm/dd/yy	8260B	DCE	26	25	12		ug/L

(k) Field logs that contain, at a minimum, water quality (field) parameters measured before, during, and after purging, and the method of purging, method of sampling, depth of water, volume of water purged, total depth of well, type of pump, and field parameters

Annual Monitoring Reports Due by 1 February of Each Year

Annual monitoring reports shall be submitted covering the period of 1 January through 31 December, **by 1 February of each year**. The Annual Report may be combined with the fourth quarter report, provided that the transmittal letter and document title clearly call out that both reports are included.

These Annual Reports shall contain an evaluation of the effectiveness and progress of the investigation and remediation, and shall include

(a) A transmittal letter, which shall include:

i. The date, report title (e.g., Annual 2015 Monitoring Report, Recology Hay Road, R5-2008-0149-056), the facility name, and Order number.
ii. Whether or not the contingency plan was implemented during the year.
iii. Whether or not the contingency plan needs to be implemented.
iv. Any violations of the General Order, NOA, and/or MRP R5-2008-0149-056 which were found since the annual report was last submitted and whether a telephone notification was provided to Water Board staff regarding the violation.
v. If any violations have been found since the last annual report was submitted, then a description of the actions taken or planned for correcting those violations shall be included.
vi. If no violations have occurred since the last annual report was submitted, then this shall be stated.
vii. The signed penalty of perjury statement, as described in the Standard Provisions General Reporting Requirements Section B.3.

(b) Both tabular and graphical summaries of all data obtained during the year, including but not limited to groundwater elevations and field and analytical results. Hydrographs of each well shall be submitted showing the elevation of groundwater with respect to the elevations of the top and bottom of the screened interval and the elevation of the pump intake. All monitoring parameters shall be graphed at a scale and clarity to clearly decipher historical trends at each monitoring point (i.e., no overlapping trend lines on the same graph). The scale of wells upgradient to the remediation areas shall be plotted at the same scale as the downgradient plots.

(c) A map showing the monitoring wells, treatment areas, and injection points for this Order. This map shall also include the location of the low-flow and high-flow ponds, previous land treatment units, and all existing and abandoned groundwater monitoring wells for this site. However, for clarity and legibility, LFG points shall not be included.

(d) Groundwater elevation contour maps and pollutant concentration maps containing all data obtained during the year.

(e) Graphical and calculated results of all statistical trend analysis.

(f) A discussion of the long-term trends as determined by statistical trend analysis and by time-series charts in the concentrations of the pollutants in the groundwater monitoring wells.

(g) An analysis of whether the pollutant plume is being effectively treated.

(h) A description of all remedial activities conducted during the year, an analysis of their effectiveness in removing the pollutants, and plans to improve remediation system effectiveness. And

(i) An identification of any data gaps and potential deficiencies/redundancies in the monitoring system or reporting program.

The Discharger shall implement the above monitoring program on the first day of the month following adoption of this Order.

Ordered by: ORIGINAL SIGNED BY ANDREW ALTEVOGT FOR
PAMELA C. CREEDON Executive Officer

12/17/2014
(Date)

ATTACHMENT A
NOTICE OF APPLICABILITY
In-Situ Groundwater Remediation at Sites with Volatile Organic Compounds, Nitrogen Compounds, Perchlorate, Pesticides, Semi-Volatile Compounds and/or Petroleum Compounds
TO ALL INTERESTED AGENCIES, GROUPS AND PERSONS:

This will serve as notice that the Regional Water Quality Control Board, Central Valley Region (Central Valley Regional Board) issued a Notice of Applicability for enrollment under *General Order No. R5-2008-0149, In-Situ Groundwater Remediation at Sites with Volatile Organic Compounds, Nitrogen Compounds, Perchlorate, Pesticides, Semi-Volatile Compounds and/or Petroleum Compounds* (General Order R5-2008-0149).

Project Title: Recology Hay Road Landfill, In-Situ Groundwater Remediation of Nitrates

Project location: 6426 Hay Road, Vacaville, Solano County

Project Description: The Central Valley Water Board issue a Notice of Applicability to allow Recology Hay Road to be enrolled under General Order No. R5-2008-0149 for the in-situ remediation of nitrate in groundwater at the Hay Road landfill in Vacaville. The main goal of this project is to reduce nitrate concentrations to less than 5mg/L, which is the concentration limit for nitrate at this facility.

On 3 September 2014, Recology Hay Road submitted a project work plan, which proposed injecting a total of 19,000 gallons of a 20% lactate solution into groundwater to stimulate biodegradation of nitrate. Injection points would be located in the western area and the eastern area of the facility.

Under the Notice of Applicability and General Order, the project proponent (Recology Hay Road) is required to monitor the impacts on groundwater and to comply with requirements and limitations. Before, during and after the injection, the groundwater upgradient, downgradient, and within the injection zone will be monitored to determine the efficacy of the remediation. Additionally, groundwater will be monitored for potential secondary unwanted constituents. The Central Valley Regional Board will oversee Recology Hay Road's compliance with General Order R5-2008-0149, the Monitoring and Reporting Program, and the conditional concurrence of the work plan.

The issued Notice of Applicability and the Monitoring and Reporting Program are on file at the address above and are available for public examination at the Central Valley Regional Board, Monday through Friday between the hours of 8:00 a.m. to 4:30 p.m., as well as on the Central Valley Regional Board website at http://waterboards.ca.gov/centralvalley.

For information, please contact Mary Boyd by e-mail at mary.boyd@waterboards.ca.gov or by telephone at (916) 464-4676.

ATTACHMENT B TO GENERAL ORDER R5-2008-0149-056
REQUIREMENTS FOR
MONITORING WELL AND INJECTION POINT INSTALLATION WORKPLANS AND REPORTS

Under Order R5-2008-0149-056, a monitoring well installation workplan is due by **30 January 2015**. Prior to installation of any groundwater monitoring wells, the Discharger shall submit a workplan containing, at a minimum, the information listed in Section 1 below. Wells may be installed after staff approves the workplan. Upon installation of the monitoring wells, the Discharger shall submit a well installation report that includes the information contained in Section 2 below. All workplans and reports must be prepared under the direction of, and signed by, a registered geologist or civil engineer licensed by the State of California.

For the Recology Hay Road project regulated under General Order R5-2008-0149-056, the screened intervals must intersect the first encountered groundwater in a zone of preferential flow. For the in-situ bioremediation project regulated under Order R5-2008-0149-056, permanent groundwater monitoring wells shall be installed throughout the life of the remediation project. Without approval by the Executive Officer, abandonment of any well required by this Order will be considered a violation of the General Order, Notice of Applicability, and MRP R5-2008-0149-056. At the completion of the project and after the Notice of Termination is issued by the Executive Officer, the wells may be properly abandoned according to an approved well abandonment work plan.

In addition to the design details for the groundwater monitoring wells, design information and diagrams for typical injection points at the eastern area shallow zone and the western area shallow zone shall be provided. The table below provides a summary of the wells that shall be included in this workplan

Well Location and Descriptor	**Monitoring Objective**
Eastern Area (shallow zone)	
EGW-3 (a.k.a. G-32)	Compliance
EGW-1	Treatment Zone
EGW-2	Transition Zone
Typical Shallow Injection Well	Amendment injection
Western Area (shallow zone)	
WGW-1	Treatment Zone
WGW-2 WGW-3	Transition Zone
Typical Shallow Injection Well	Amendment injection

SECTION 1 - Monitoring Well Installation Workplan

The monitoring well installation workplan shall contain the following minimum information:

A. General Information

- Purpose of the well installation project,
- Brief description of local geologic and hydrogeologic conditions,
- Proposed monitoring well locations and rationale for well locations,
- Topographic map showing facility location, roads, and surface water bodies,
- Large scaled site map showing all existing and abandoned on-site groundwater monitoring wells, proposed wells, proposed injection points, surface drainage courses, surface water bodies, ponds, landfill units, waste pile, land treatment units (existing and former), and major physical and man-made features. For clarity and readability, the LFG wells and LFG monitoring points shall not be included on this map..

B. Proposed Well Numbers

The well numbers for each upgradient, treatment, transition, and compliance well to be installed under this Order must be provided in the text and must correspond to the well numbers on the site map. In addition, the injection wells which are scheduled to be dosed with the bromide tracer shall be identified on the map with an injection point ID numbers and shall be cross-referenced in the text of the workplan.

C. Drilling Details for Monitoring Wells and Injection Points

- On-site supervision of drilling and well installation activities,
- Description of drilling equipment and techniques,
- Equipment decontamination procedures,
- Continuous soil sampling and logging,
- Logging methods complying with ASTM D2488-93 *Method for Visual Classification, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for field work.*

D. Diagram and Narrative: Injection Point and Groundwater Monitoring Well Design

The well designs must be provided in both a narrative description and in a diagram, which must include the construction details of the proposed monitoring wells and the injection points:

- Temporary Injection Points: Diagram and narrative with the type of drill rig/direct-push rig and pump truck; diameter of injection point; casing details; depth at which injection will occur for each treatment zone; type of fittings/tooling on the rig to inject the amendment into the subsurface; number and location of injection points; and any other details needed to define the injection points.
- Permanent Groundwater Monitoring Wells:

i. Shallow Zone Wells: Procedures to identify the shallow zone and to install the screen interval so that it intersects the first encountered groundwater in a zone of preferential flow.
ii. Borehole diameter,
iii. Casing and screen material, diameter, and centralizer spacing (if needed),
iv. Type of well caps (bottom cap with either a screw on or secured with stainless steel screws),
v. Anticipated depth of well, length of well casing, and length and position of perforated interval,
vi. Thickness, position and composition of surface seal, sanitary seal, and sand pack,
vii. Anticipated screen slot size and filter pack.

E. Well Development

Well development must be performed at least 48 hours after the sanitary seal has been placed, and must include the following:

- Method of development to ensure maximum removal of fines from the vicinity of the screen and to ensure free-flow of fluids (i.e., over-pumping, air-lift, surge block and bailer, jetting, etc.),
- Parameters to be monitored during development and the record keeping procedures,
- Method of determining when development is complete,
- Disposal of development water.

F. Well Survey - Horizontal and Vertical Coordinates

- Name of the Licensed Land Surveyor or Civil Engineer,
- Datum for survey measurements,
- List of well features to be surveyed, including the top of casing, ground surface, and horizontal and vertical coordinates,
- Accuracy must be defined as within ±0.1-foot horizontal and ±0.01-foot vertical.

G. Water Level Measurement

- The elevation reference point at each monitoring well must be within ±0.01-foot,
- Identification of the reference point for measuring the elevations (i.e., top of casing or ground surface),
- Ground surface elevation at each monitoring well must be within 0.01-foot,
- Method and time of water level measurement must be specified.

H. Sampling and Laboratory Analysis

Groundwater sampling must be performed after the well is developed. Groundwater sampling, field tests, and laboratory analysis must comply with the requirements in the General Order R5-2008-0149-056. All Method Detection Limits, Practical Quantitation

limits, and “trace” concentrations must be reported on the laboratory reports, as required in MRP R5-2008-0149-056.

I. Proposed Schedule for Start and Completion of Work

A proposed schedule for the start and completion of work shall be included, which shall include the schedule for each area for injection and for well construction.

SECTION 2 - Monitoring Well Installation Report

No later than 30 March 2015, a monitoring well installation report shall be submitted, as required by the Notice of Applicability..

A. General Information

1. Purpose of the well and injection point installation project,
2. Brief description of local geologic and hydrogeologic conditions encountered during installation of the wells,
3. Number of monitoring wells and injection points installed,
4. Copies of the County Well Construction Permits,
5. Topographic map showing facility location, roads, and surface water bodies,
6. Scaled site map showing all previously existing wells, newly installed wells, surface water bodies, buildings, utilities, and other major physical and man-made features. All wells for the in-situ project shall be identified by well ID number in a table on the map.

B. Drilling and Injection Point Details – Narrative and Graphic

1. On-site supervision of drilling and well installation activities,
2. Drilling contractor and driller's name,
3. Description of drilling equipment and techniques,
4. Equipment decontamination procedures,
5. Soil sampling intervals and logging methods,
6. Well boring log for each well:
    a. Well boring number and date drilled
    b. Borehole diameter and total depth
    c. Total depth of open hole (same as total depth drilled if no caving or back-grouting occurs)
    d. Depth to first encountered groundwater
    e. Depth to stabilized groundwater
    f. Detailed description of soils encountered using ASTM D2488-93 *Method for Visual Classification, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for Field Work*.

C. Diagram and Narrative: Well and Injection Point Construction Details

1. Construction details for the injection points:
    a. Diagram and narrative with the type of drill rig/direct-push rig and pump truck;
    b. Date installed;
    c. Diameter of injection point;
    d. Casing details;
    e. Depth interval at which injection occurred for each well;

f. Type of fittings/tooling on the rig to inject into the subsurface;
g. Number and location of injection points.

2. Construction details for groundwater monitoring wells
   a. Well/injection point number, date started, date completed, geologist's name
   b. Land survey data
   c. Total depth of injection wells
   d. Total depth drilled for monitoring wells
   e. Drilling Contractors and drillers names and address
   f. Depth of open hole (same as total depth drilled if no caving occurs)
   g. Method and materials of grouting excess borehole
   h. Footage of hole collapsed
   i. Length of slotted casing installed
   j. Depth of bottom of casing
   k. Depth to top of sand pack
   l. Thickness of sand pack
   m. Depth to top of bentonite seal
   n. Thickness of bentonite seal
   o. Thickness of concrete grout
   p. Boring diameter
   q. Casing diameter
   r. Casing material
   s. Size of perforations
   t. Well elevation at top of casing
   u. Initial and stabilized depth to groundwater
   v. Date of water level measurement
   w. Monitoring well number
   x. Date drilled

D. Well Development

1. Date(s) and method of development of each well,
2. Method of development,
3. How well development completion was determined,
4. Volume of water purged from well and method of development water disposal,
5. Field notes from well development.

E. Well Survey

1. Coordinate system, epochs, bench marks, horizontal controls, accuracy, and precision,
2. Horizontal and vertical survey results of ground surface and of the casing elevation with the cap removed (horizontal to $\pm$0.1-foot and vertical to 1/100th foot),
3. California Registered Civil Engineer or Licensed Surveyor's report, field notes, and stamp/signature in an appendix,
4. Description of the measuring points (i.e. ground surface, top of casing, etc.),

5. Tabulated survey data with well numbers and horizontal and vertical coordinates.
6. Tabulated survey data for the corner points of each injection area.

ATTACHMENT C TO GENERAL ORDER R5-2008-0149-056
REQUIREMENTS FOR
MONITORING WELL ABANDONMENT REPORTS

Within 30 days of abandonment of any groundwater monitoring or injection well, the Discharger shall submit a report containing, at a minimum, the information listed in below. All reports must be prepared under the direction of, and signed by, a registered geologist and civil engineer licensed by the State of California.

Minimum Contents for a Monitoring Well Abandonment Report

A. General Information

1. Purpose of the well abandonment project.
2. Brief description of local geologic and hydrogeologic conditions.
3. Identification and number of monitoring wells abandoned.
4. Topographic map showing facility location, roads, and surface water bodies.
5. Scaled site map showing existing wells, newly abandoned wells, surface water bodies, and direction of groundwater flow. For readability, do not include LFG extraction and LFG monitoring wells.

B. Original Well Construction Details

1. Well numbers and dates installed.
2. Diagram with well construction details.
3. Copy of original boring logs.

C. Water Well Standards, Section 23

The California Department of Water Resources *Water Well Standards*, Section 23 is available at http://www.water.ca.gov/groundwater/well_info_and_other/california_well_standards/wws/wws_combined_sec23.html

1. Results of investigation to determine the wells condition, construction details, and whether there are obstructions that will interfere with the process of filling and sealing, as required in Section 23 of the Water Well Standards.
2. Discussion of filling and sealing conditions, as required in Section 23 of the Water Well Standards.
3. A discussion of the abandonment and materials, including the distance between the top of the cement grout and the subgrade of DM-6.
4. Diagram with placement, distance between top of cement grout and bottom of subgrade elevation at DM-6, depths of placed materials, and types of material placed for abandonment.

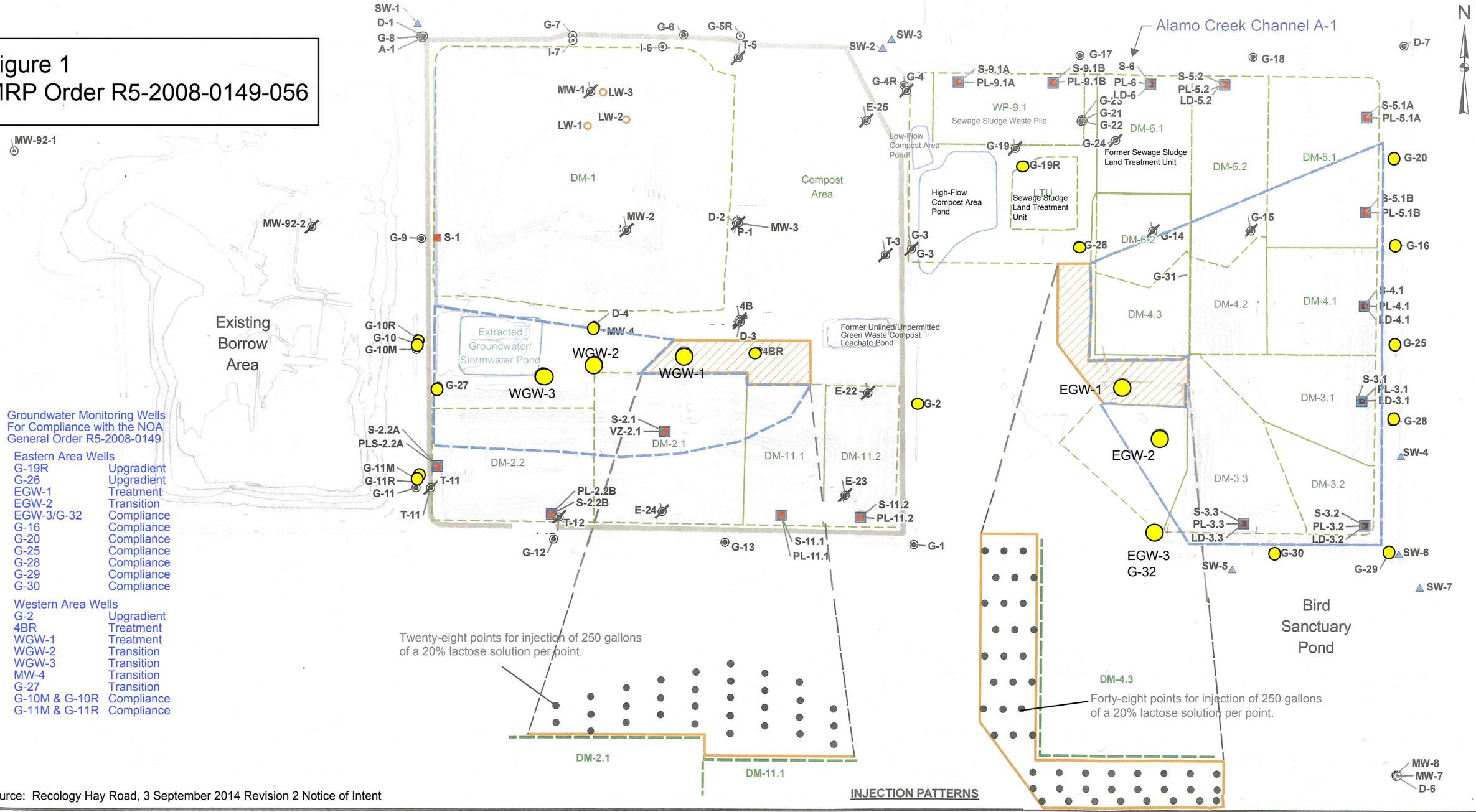
D. County Requirements

1. Copy of permit.
2. Signed copy of County's observations during the abandonment.

E. Table with Well Survey Data

1. Coordinate system, epochs, and northing, easting, and elevations
2. The date the original survey was performed.
3. Confirmation whether survey data was uploaded to the State's Geotracker system.

Figure 1
MRP Order R5-2008-0149-056



Groundwater Monitoring Wells For Compliance with the NOA General Order R5-2008-0149

Eastern Area Wells	
G-19R	Upgradient
G-26	Upgradient
EGW-1	Treatment
EGW-2	Transition
EGW-3/G-32	Compliance
G-16	Compliance
G-20	Compliance
G-25	Compliance
G-28	Compliance
G-29	Compliance
G-30	Compliance
Western Area Wells	
G-2	Upgradient
4BR	Treatment
WGW-1	Treatment
WGW-2	Transition
WGW-3	Transition
MW-4	Transition
G-27	Transition
G-10M & G-10R	Compliance
G-11M & G-11R	Compliance

Source: Recology Hay Road, 3 September 2014 Revision 2 Notice of Intent

LEGEND

Destroyed wells
- Destroyed Groundwater Monitor Well
- Destroyed Landfill Gas Probe

- Groundwater Monitor Well
- Piezometer
- Landfill Gas Extraction/Leachate Well
- Leak Detection Sump
- Leachate Sump
- Lysimeter
- Surface Water Sample Location

- Pond
- Disposal Module
- Groundwater Extraction Trench
- Perimeter Slurry Wall

- Treatment Zone
- Transition Zone

Upgradient, treatment, transition, and compliance groundwater monitoring wells installed to comply with the NOA for General Order R5-2008-0149-XXXX

500 0 500 Feet

PROJECT: RECOLOGY HAY ROAD GROUNDWATER MONITORING SOLANO COUNTY, CALIFORNIA

TITLE: **NITRATE TREATMENT AND TRANSITION ZONES**

PROJECT No.		123-97608	
DESIGN	MM	7/26/2012	SCALE: AS SHOWN
GIS	MM	6/13/2014	
CHECK	KJ	6/13/2014	
REVIEW	KJ	6/13/2014	